VOL. VI, No. 2

FEBRUARY, 1951

AGRICULTURAL CHEMICALS

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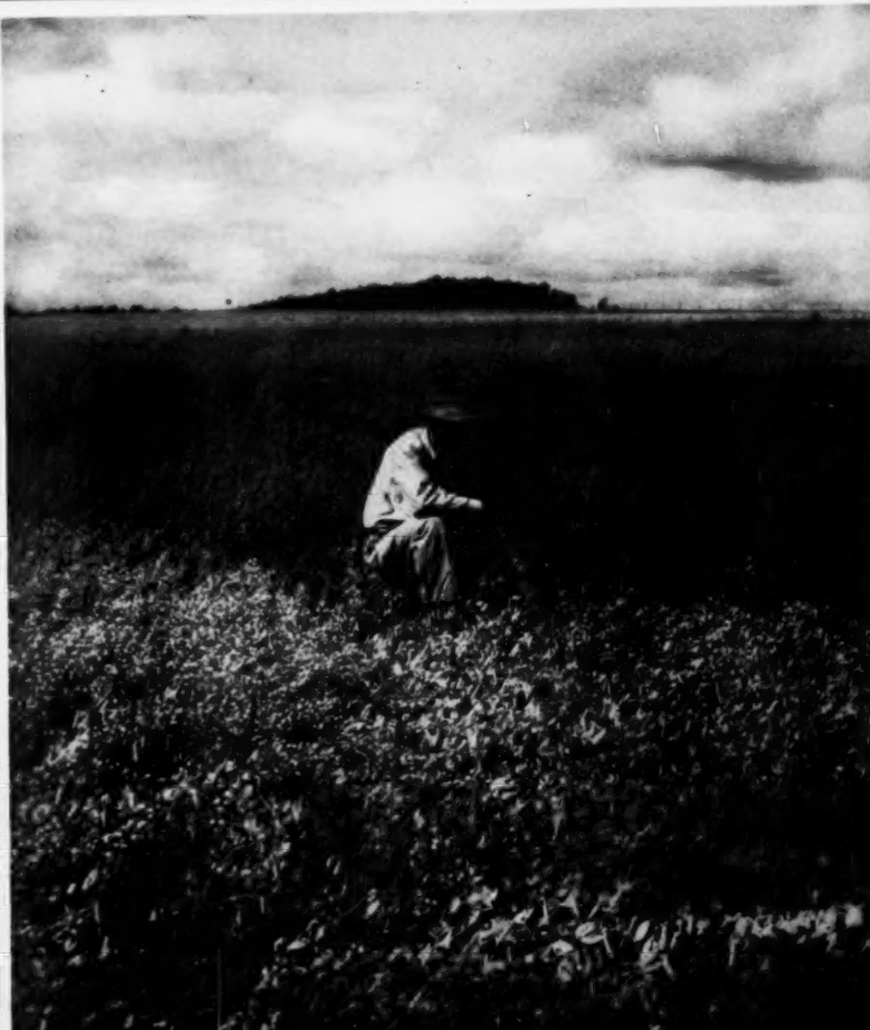

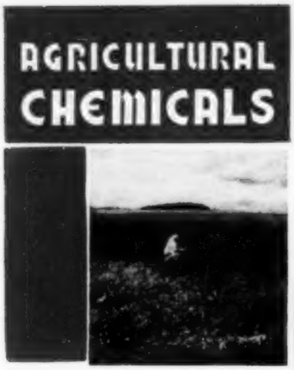

THIS MONTH'S COVER

Control of wild oats with IPC herbicide. Dr. C. I. Seeley, University of Idaho, examines weed-free peas which yielded 1,550 pounds of clean, dry peas per acre. Untreated areas in background, averaged 580 pounds per acre. See article on page 34, this issue. Photo by University of Idaho.

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A Monthly Magazine For the Trade

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In This Issue:

AGRICULTURAL CHEMICALS

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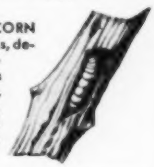

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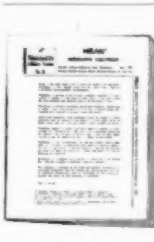

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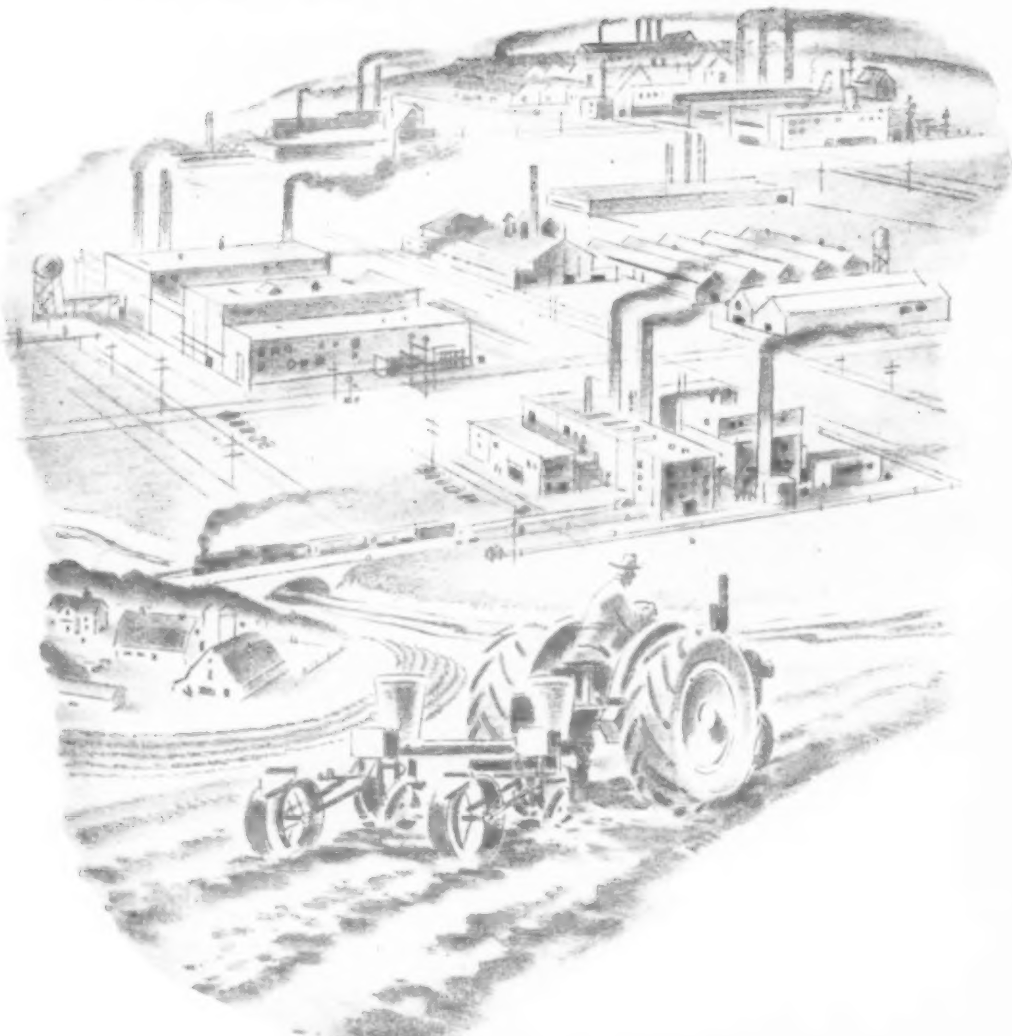

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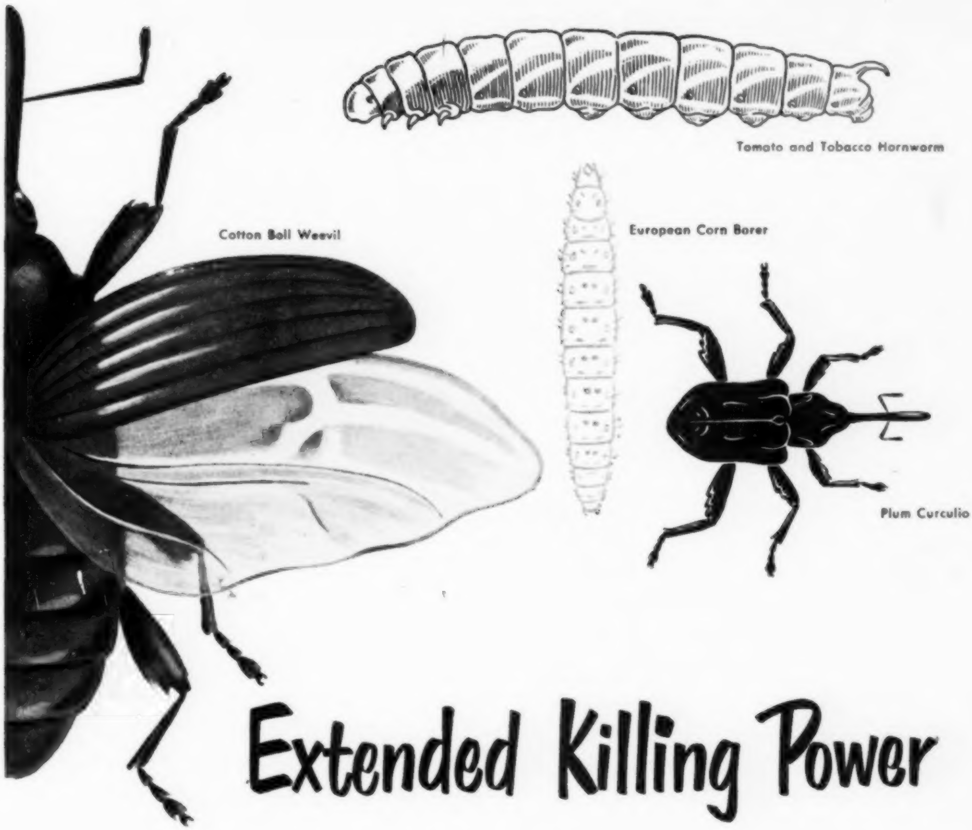

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ARMOUR STICKER keeps insecticides on the plant longer!

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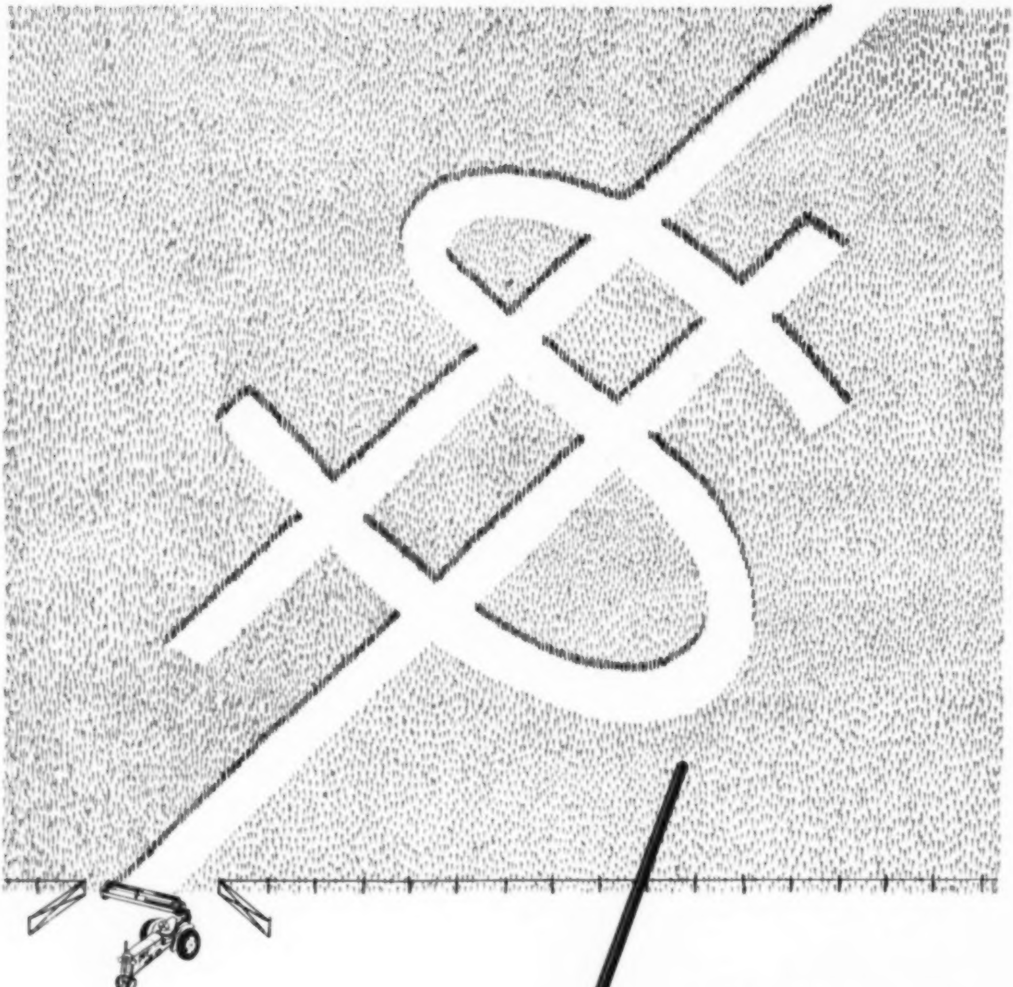

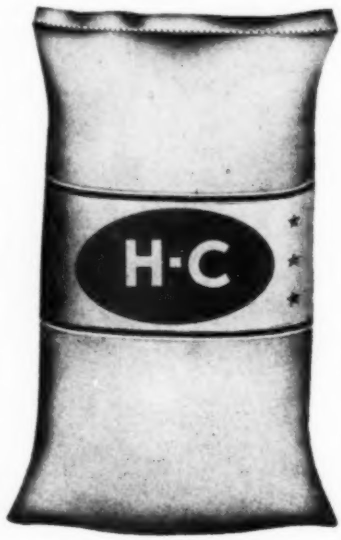

H-C

THE EDITOR COMMENTS

WHY manufacturers of basic agricultural chemicals continue to produce some of them under present conditions is a puzzle to us. We have a hunch that if we were making BHC, DDT, 2,4-D, and numerous other similar products today, we would quit. And the chlorine, benzol, alkalies and other scarce raw materials, we would channel into other operations where not only the margin of profit is much wider, but where the headaches of merely doing business are of a less acute variety. Specifically, among these headaches we have in mind constant harassment as a result of investigations and hearings, and the repeated threat of new, and often unnecessary legislation, both state and federal. This is what every producer of insecticides, fungicides, herbicides, and the like faces today, and is the chief reason why if we were in the business we would be tempted to quit it cold and move on to greener pastures.

In mentioning harassment of agricultural chemical producers by government agencies of one sort or another, we specifically want to except the U. S. Department of Agriculture and certain state law enforcement agencies. Where they know the score and understand what they are doing, industry has little quarrel with them. But, it is this everlasting barrage of investigations, hearings, proposed legislation, and general harassment by obviously unqualified or prejudiced persons or agencies which makes the insecticide and fungicide business more of a nightmare with each passing day.

Investigations may be carried on until doomsday. Reams and reams of testimony may fill the pages of hearing records. But the cold fact remains that without insect and fungus control and without chemical plant food, the nation cannot be fed. And without the companies which manufacture these agricultural necessities, there can be no production. Harass their manufacturers out of the business,—over the past few years several of our leading chemical producers have quit the field,—and the result is apparent. Few manufacturers, inadequate supplies, high prices, and widespread crop failure. It can come, and we warn that it will come if common sense does not replace political scrambling for headlines.

To summarize the whole thing bluntly, agricultural chemical producers are thoroughly disgusted. It will not take too much more of this harassment to drive more of them out of the business. With their same equipment, their same benzol, chlorine, et al, they can make more money elsewhere. Why should they remain and continue to be the whipping boy for politicians?

PROBABLY at no time in the past has the attention of so many Congressmen and government officials been drawn to the use of pesticides in agriculture and the effect of such chemicals on public health. The select committee investigation coming immediately after the Food and Drug Administration hearing has put the entire industry in the spotlight, which is to say, on the *spot*.

In the light of this, the matter of label claims comes to the fore in an unusual way. Now is the time for manufacturers to pay particular attention to their advertising and labeling claims . . . not that it is unimportant at other times, . . . but right now any inconsistency, any unsupported statement regarding toxicity or efficacy of a pesticide, is likely to be picked up and magnified far beyond its actual significance. We hope that all manufacturers will make sure their printed claims are in line with the facts.

Just how lax some members of the industry can be in such details, is illustrated by the recent "Notices of Judgment under the Federal Insecticide, Fungicide and Rodenticide Act" which lists 25 seizures, of which 24 were for failure to register under the Act. And when was the registration deadline? June 25, 1948. This means that *even yet*, despite reminders too num-

(*Editorial Continued on Page 81*)

FOR the purpose of considering physiological effects and environmental hazards, the agricultural pesticides which are now in common use may be divided into three general classes: the inorganic insecticides, the organic phosphates, and the chlorinated hydrocarbons. The use of any chemical for pest control will be determined, in large measure, by its effectiveness in the form in which it will be used against the pest to be destroyed. The environmental health hazard produced by the chemical, disease, therefore, result from unforeseen circumstances or from carelessness in handling the product. In either event, the physiological response of the individual is usually prompt, and the series of events which led to the exposure is well known or can be determined. In such cases, removal of the toxic material and medical treatment of the patient usually follow as a matter of course and, regardless of the outcome, the sequence of cause and effect can be determined with a reasonable amount of accuracy. animal experimentation into human experience without appropriate consideration of the specificity of species. Other diversities of opinion have developed because an understanding is lacking of the actual conditions of exposure which result from ordinary use of the material.

Any understanding of the general problem must be based upon a full realization that all insecticidal chemicals are toxic materials. This fundamental fact cannot be ignored successfully if factual knowledge is

Environmental Health Aspects of Certain Agricultural

therefore, will be a function not only of the physical state of the compound (which will be determined by the method of use) but also of the concentrations to which humans are likely to be exposed. Consequently, these are the prime considerations in relation to the public health, not only with respect to the hazards involved in brief and sudden exposure to severe conditions, but also and particularly those associated with long-continued intermittent exposure to small amounts of the compounds.

When exposure to high concentrations of the chemical brings about enough absorption quickly, all of these toxic compounds will, by their very nature, produce serious deleterious physiological consequences. These phenomena of acute poisoning have been seen and studied thoroughly both in animal experiments and in human subjects, particularly in the case of older insecticides. For this reason, certain warnings and precautions have been widely circulated both by manufacturers and health agencies. The environmental health hazards which cause acute

Effect of Long Exposure

WHEN the effects of continuous exposure to small amounts of toxic materials are in question, the environmental health aspects of the substance require careful evaluation. In general, the effects of prolonged exposure to any substance will be determined by the physical and chemical properties of the substance, the amounts of the substance to which the organism is likely to be exposed, the susceptibility of the exposed species to the toxic material, and the manner in which absorption takes place. In view of the number of these factors, it is no wonder that so much apprehension and confusion existed concerning the effects of prolonged exposure to small amounts of these pesticides.

This confusion suggests the need for more careful research and more detailed experimental work. In many cases, however, the work of hundreds of investigators has served further to obscure rather than to clarify the existing situation. Much controversy has developed because of attempts to translate the results of

to be obtained. Thus, in sufficient quantities, any insecticide can be expected to produce some type of toxic physiological response in humans. However, this response will vary according to the circumstances of the body's absorption and elimination of the toxic material. Its absorption will depend upon the inherent chemical characteristics of the compound, the concentration, and route of entry into the body. Elimination will depend upon the metabolism, the extent of the accumulation of the material within the various tissues of the organism, and the detoxification mechanisms, if any, which are involved.

One of the first problems in human exposure is concerned with the method of use and the quantity of the material which is commonly employed. This type of information is frequently overlooked but it is of the utmost importance in any consideration of chronic effects. Thus, in a review of the materials most commonly employed against normal infestations of boll weevil, for example, it is apparent that the amount of insecticide which is deposited will vary not

only according to the method of application but particularly with respect to the chemical compound itself. In combatting this pest, rates of application have been recommended as follows: calcium arsenate, 10-15 lb. per acre; DDT, 0.5-1 lb. per acre; chlordane, 0.5-1 lb. per acre; toxaphene, 1 to 2 lb. per acre; lindane, 1/3 lb. per acre; aldrin, 0.07 to 0.25 lb. per acre; dieldrin, 0.05 to 0.15 lb. per acre; and nicotine, 0.1 to 0.2 lb. per acre.

These figures definitely indicate that, in practical terms, exposure and absorption will show considerable variation under ordinary conditions of use and that in addition to the relative toxicity, the amount used must be well understood and considered. This is not meant to suggest that the amounts of the materials employed will determine the toxicological effects, but it demonstrates that any consideration of physiological effect must take into consideration the amount of material to which an individual is likely to be exposed. For this reason, authorities in the field of environmental health have developed and advocated certain maximum allowable concentrations for different toxic materials which may contaminate the atmosphere.

Unfortunately, in the case of the pesticides, the only maximum allowable concentration which has been set, even tentatively, for atmospheric contamination is the figure of 5 mgm./cu. meter of air for DDT. This specification has been promulgated only by the Michigan State Department of Health. Time and experience will of course produce increased knowledge of the methods of usefulness and the toxic limits of these compounds. Thus, it can be anticipated that maximum allowable concentrations eventually will be advocated by other agencies and for many of the other insecticides.

All Factors Important

THE amount of material used per acre will not be the only important factor in the evaluation of the environmental hazard. The absorbability of the compound and its effect on humans, both immediate and delayed, are also necessary considerations to the entire question. But these two factors alone will not be the only criteria in judging the toxicity of the compound. Definite knowledge of all the factors involved is essential in evaluating the hazard properly. Other important considerations will be the likelihood of human exposure, the presence of other toxic materials in the insecticide, the effect of a solvent or vehicle upon the dispersion of the material and upon the mechanisms of absorption into the body, and the route of absorption which may be expected. All these possibilities will, in one fashion or another, modify the environmental health aspects in a variety of ways.

Pesticides

by

Frank Princi, M. D.*

Cincinnati, Ohio

In any use of chemical products, industrial health problems must be considered even before any large scale manufacture is attempted. Studies of these problems will serve not only to protect the worker against the hazards of manufacture, but will also provide toxicologic information which will be useful generally in the study of the effects of these materials on other exposed persons. In the case of insecticides, therefore, it seems imperative that occupational exposure and the effects of such exposure on the workers be evaluated carefully. Such studies are an important part of any industrial process and, in most cases, have received at least some consideration.

Inorganic insecticides as a class may be expected to produce effects which are characteristic of the toxic elements contained. Thus, the arsenicals will produce poisoning which is typical of arsenic intoxication in addition to toxic effects which may arise from other substances which happen to be in combination with the arsenic in the particular insecticide. In similar fashion, the effect of fluoride insecticides can be understood frequently in terms of our previous knowledge of the use of these materials. In general, therefore, it may be stated that the hazards which are produced by the inorganic insecticides are fairly well known, and that the toxicity of these substances is understood so that we can, without too great difficulty, evaluate new findings in terms of previous knowledge.

However, such previous knowledge does not exist in the case of the newer insecticides. As a general class, the organic phosphate compounds are known to exert a similar type of physiologic effect, although they differ appreciably among each other in toxicity. Because of their chemical instability, which allows but little persistent residue on sprayed agricultural products, these substances have been considered not to be serious public health hazards (1). But this factor does not modify the environmental health problem

*Presented at the Denver Meeting of the American Association of Economic Entomologists, December 20, 1950.

which is produced by the manufacture, formulation and field use of these compounds. When absorbed by humans in sufficient concentrations, either through inhalation or ingestion, they give rise to rapid and fulminating symptoms. Although these compounds (in common with many of the other pesticides) will usually first produce central nervous system symptoms, their gravest immediate clinical danger lies in their rapid production of pulmonary edema. For this reason, any delay in treatment may be fatal since there is a very short latent period in the development of the toxic symptoms. This relatively rapid physiologic response is typical of this entire group of organic phosphate compounds, and all cases of such intoxication will require immediate hospitalization.

When the primary effect of the toxic material is exerted on the gastrointestinal tract or the central nervous system, clinical signs and symptoms may be delayed and will usually develop slowly. This type of response usually provides forewarning of excessive exposure and opportunity for adequate medical treatment. In this general class fall the chlorinated hydrocarbon insecticides of which the most commonly used are: DDT, chlordane, lindane, toxaphene, Methoxychlor, dieldrin, and aldrin.

Toxicological Studies

EFFECTS of some of these substances on man have been widely studied but not entirely understood. One of these in particular, DDT, has been subjected to more toxicological investigation than has any other organic compound, yet there is much disagreement over the interpretation of the experiments of different groups of investigators. It seems appropriate to discuss, in a fairly thorough manner, this comprehensively-investigated compound, since new compounds of this class can be compared with it in many respects, both from the aspect of relative toxicity and that of comparative type and degree of environmental hazard.

Despite many differences of opinion on other matters relating to DDT, certain facts concerning the effects of exposure to this material have never been denied. Perhaps the most important of these facts, with reference to environmental health, is that among the many reports of DDT intoxication in the literature, there is no known report of a fatality which was due unquestionably to DDT. This statement is the more remarkable, in view of the tremendous amounts of the material which have been used since 1942, in most cases without precautions, and in some cases, with absolute carelessness. In spite of this extremely valuable human experience, the statement has been made that the "potential hazard of DDT may have been underestimated" (1). It seems reasonable to inquire how such an inference was derived.

How Toxic is DDT?

AN examination of the literature reveals that the experimental work which led to this deduction was done on small animals. Two important findings have been reported as definite evidence of the chronic toxicity of this compound. The more striking of these findings is the development of liver damage among rodents fed on diets containing small amounts of DDT. Although these reports have been used to demonstrate great toxicity of the compound, it is significant that these liver changes have not been demonstrated in other animals whose diets contained similar small amounts of the compound. Without minimizing the importance of experimental results on any, or even a single, species of animal, it is not wise to translate such experimental findings to human beings, particularly when the observations made on exposed persons have shown the situation to be otherwise. This should not be construed to signify that DDT is non-toxic, but it certainly indicates that the amounts which exposed persons are likely to absorb will in all probability produce no deleterious effects.

The second important finding is that storage of the compound in the body fat occurs at any level of ingestion, giving rise to the opinion that even small amounts of DDT are dangerous. This phenomenon is true in the case of practically all the chlorinated hydrocarbon insecticides. Mere storage alone cannot be considered an unusual factor in the case of toxic materials since many toxic materials are known to be stored in body tissues without deleterious effect. Lead is a well-known example of a toxic material which is stored in the body tissues of everyone. Yet in the small amounts absorbed by the average person, storage and excretion have not been found to have an adverse effect on the health of the individual under even the most dramatic of conditions with respect to metabolic disturbances.

In the case of DDT, it has been suggested that weight loss will be likely to result in the mobilization of the toxic material because of sudden loss of fat. With respect to small animals, this fact is most certainly correct, and the starvation of small animals previously fed upon sufficient amounts of DDT, will result in the release of the toxic material and the development of characteristic tremors. But again, species differences must be carefully considered since small animals consume relatively tremendous amounts of food, and can, therefore, lose as much as one quarter of their body weight over night in one day of starvation. Such a situation is certainly not true of humans. At the slow rate a person may lose weight, sufficient release of DDT to induce toxic effects is extremely unlikely, and has never been demonstrated. The latter is true despite the fact that examination of the fat of persons without any known exposure to DDT has shown storage up to 50 p.p.m., and the body fat of DDT workers has been shown to contain levels up to 900 p.p.m. (2).

The foregoing information suggests that DDT, with full appreciation of its known toxicity, can be and has been handled with safety in the concentrations to which both workers and other persons are likely to be exposed. Thus, the toxic effects of the newer chlorinated hydrocarbon insecticides should be assessed in terms of effects produced by the amounts which a person is likely to absorb.

That safe levels of absorption do exist, has been demonstrated in a recent clinical and laboratory study (3) of workers who were engaged in the manufacture and formulation of these compounds for periods up to three years. Although these persons had been exposed to atmospheric concentrations of the materials which were in excess of 5 mgm. per cubic meter of air and to repeated skin contact with the toxic materials, no deleterious effects were found in any of the workmen. These findings are particularly of note since these men were exposed to considerably larger amounts than those to which the ordinary person can expect to be exposed. To minimize the importance of these findings by suggesting that absorption by inhalation may not be as serious as absorption by ingestion is unrealistic and contrary to factual physiological information.

Human experience must receive serious consideration in any estimate of the toxicity of a compound for man, and all relevant investigation must be properly correlated in order to evaluate properly any environmental health hazard. This concept was best expressed by Foulger (4) in 1949: "To collect data for the assessment of health hazards at the several stages of development described here, physical chemistry, biochemistry, physiology, toxicology, pathology, and clinical medicine are all employed, plus an intimate knowledge of manufacturing procedures and especially methods of use. But these are not used efficiently if isolated in separate departments. The whole program of investigation must be planned and timed with the closest possible correlation of all fields of knowledge. Above all, they should never forget that their ultimate decisions must be made in terms of human health."

Despite this admonition, certain remarkable warnings have been widely published without reference to published experimental findings. An outstanding example is the statement that "dieldrin and aldrin are approximately ten times more poisonous when applied to the skin than when swallowed" (1). If this statement is true, these substances do indeed possess remarkable qualities, since this is not known to be true of any other toxic compound when ingested and applied upon the skin in the same form. In any event, the findings of Hayes, Ferguson, and Cass (5) not only disagree with this statement, but indicate that the reverse is true, while human experience (3) indicates that these compounds can be and have been used with safety in the presence of gross contamination of the skin.

It seems reasonable to suggest, therefore, that environmental health hazards be evaluated on the basis of all available information. Animal experimentation is of proved value and cannot be dismissed without serious consideration, but in any discussion of environmental health hazards, it seems only logical that the exposed individual and all the environmental factors be evaluated carefully. Unquestionably, more adequate information is necessary and appropriate care should be taken by all persons who have any contact whatsoever with pesticides. But hysterical warnings and preconceived ideas will serve only to frighten, or will lead to indifference and carelessness when the expected effects are not forthcoming, or may even result in the complete prohibition of use of an otherwise desirable substance.

An excellent example of the latter instance has been seen in the case of the baking industry. For thirty years nitrogen trichloride had been used as a bleach for white flour without the production of known toxic effects among workers or consumers. Despite this extensive human experience, the finding that nitrogen trichloride would produce running fits in dogs resulted in the prohibition of the use of nitrogen trichloride for bleaching flour. Although later work (6) showed conclusively that this material is harmless to humans, the use of nitrogen trichloride is still forbidden by law and the baking industry today uses bleaches which are inferior to the substance that was employed for three decades without harm. This example is significant only insofar as it demonstrates the lack of consideration for all the essential toxicological information.

In the case of pesticides therefore, the important environmental health aspects which require serious study may be enumerated as follows:

1. The manner in which the compound is to be used.
2. The physical state of these compounds.
3. The amounts of the compound to which workers are likely to be exposed.
4. The effects of these amounts on the human organism.
5. The routes of absorption which can be expected.
6. Other chemicals with which they will be formulated, and the influence of the latter on the toxicity, physical state and absorbability of the agent under examination.

The full elucidation of these items demands a knowledge not only of the physiological action of the material, but also of the maximum degree of exposure which may be permitted without expected damage to the organism. Only by careful use and proper study of exposed persons can such adequate information be obtained. ★★

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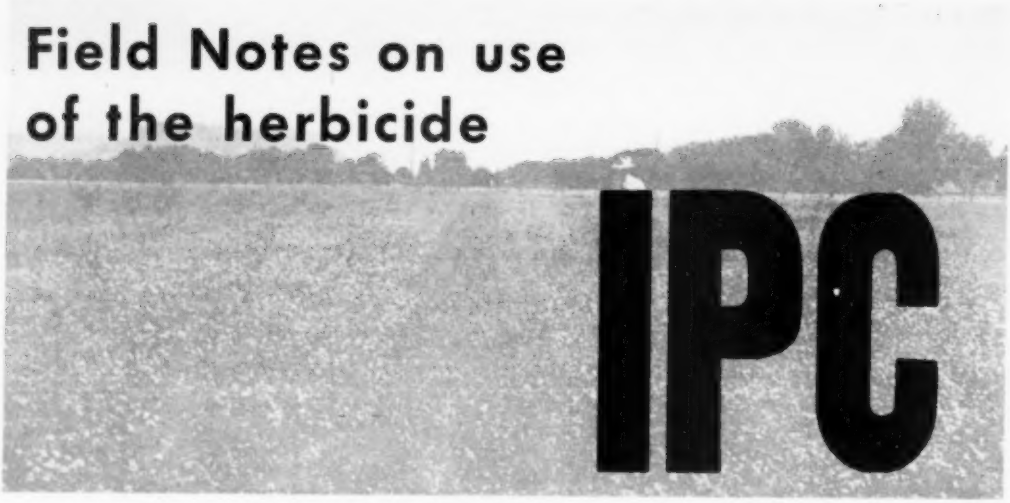
Field Notes on use of the herbicide IPC



A NEW type of weed killer is seen in IPC (isopropyl N-phenyl carbamate), which is applied as a spray to the soil rather than being directed to the weeds themselves. IPC prevents as well as kills weed growth, remaining for a considerable time in most soils. Thus, its action through plant roots differs from that of contact or foliage sprays with which the trade is more familiar.

The material may be described, with some exceptions, as a selective grass killer, inasmuch as it will kill grassy weeds in many broadleafed crops without harm to the valuable plants. This is quite in contrast to 2,4-D which in most cases controls broadleafed weeds in grass-like crops of grain.

However, IPC does not affect all grasses in the same manner, nor is it safe to use on all broadleafed plants. There are also different types of IPC. Certain derivatives will kill some weeds that IPC itself will not, which points up the possibility of new uses for the material in many areas. For instance, in some cases, IPC can remove one grassy weed from another grass seed crop. Likewise, a certain few broadleafed weeds can be controlled in many broadleafed crops.

Physical characteristics of IPC also lend themselves to further expansion in the herbicide field. The material has shown suitability for use in combinations with many of our present weed killing compounds. It is non-corrosive, and tests on laboratory animals have established its acute toxicity as not exceeding normal hazards.

Growth Regulating Ability?

ALTHOUGH IPC has attracted major attention as a selective grass killer, other characteristics have been attributed to it. Freed (1) has noted that IPC may have growth-regulating influences on certain crop plants that may equal or surpass its influence as a weed killer. This is not discounted by Harvey (2), Arle (3), or Seeley (4). Seeley (4) indicates a growing belief among some Idaho pea growers that IPC may exert other beneficial influences on seed yields besides that obtained from eliminating the competition from wild oats. Interest is being shown in the enzyme activating possibilities of IPC and its derivatives. Used within the limits of knowledge gained from several years' field experience, IPC can do a successful job of weed control not possible with any other known weed killer. For certain purposes, the economic and practical values of IPC have not yet been limited in the eyes of many enthusiastic seed growers who behold, and profit from its results. A broader scope in use of IPC is constantly developing as research and field trials progress.

Background photo above: streak in field plainly shows effect of using IPC herbicides. Photo by Shangle Studios. Medford, Oregon.

IPC prevents, or seriously disrupts, cell division within certain affected plants, thus arresting growth functions. Although winter cold, or other unfavorable growing conditions, slow these processes greatly, they are none-the-less continuous, especially in the underground portions. If dosage of IPC is heavy enough, it will kill certain grasses even during this so-called dormant or winter season.

IPC is applied evenly over the soil surface and is taken by rains, or irrigation into the root area of the soil. Control is effected when the grass roots or the young expanding embryo of the grass seed come in contact with even minute amounts of IPC. Affected plants, if small, usually die within two weeks. Older

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grasses cease growing and may appear in good color for many weeks before finally becoming dry and falling over. This final change-over from green to dead grass may occur within a day or two. Grasses are best controlled when they are small and before they have tillered. Shallow-seeded grass seeds falling on undisturbed soil such as in ladino clover or alfalfa fields can be controlled with IPC by making application so that the herbicide will be present when soil moisture and temperature conditions germinate the seeds. This may not in all cases require rain in areas subject to sufficient dripping dew or heavy fog.

An application too early in the fall may control one or two early fall grasses, but if winter rains are excessive, IPC will lose much of its effectiveness before winter germinating or spring grasses appear. Little relief will result for summer harvested crops in this way, so it may be better in some cases to apply stronger dosages of IPC, where the crop involved is tolerant. It may also be better to make a later than usual application when grasses are somewhat taller than to control the early grasses while very small and lose effective control of later germinating weeds. Such decisions require individual consideration, of course.

Application of IPC before emergence of weeds kills grasses and some few broadleafed plants such as Common Chickweed (*Stellaria Media*), Knotweed or "wiregrass' (*Polygonum aviculare*, L.), and Purslane (*Portulaca sp.*). Preemergence application of IPC will frequently thin out by stunting, certain other seedling broadleafed weeds such as Smartweed (*Polygonum sp*), Lambs Quarters (*Chenopodium sp.*), Curly or Sour Dock (*Rumex crispus* L.) in clover and other crops, allowing the crops to overtake weakened weeds.

In some weed control programs it is best to apply IPC before seeding of the crop, as is done in field peas. IPC is applied by plane or ground sprayer to land which has been readied for sowing of peas. Discing tools are slightly set for mixing top soil and IPC, broadcasting seeder or drills are attached behind the discing tools except where sowing is by airplane, and the job is completed. When the wild oats germinate they are killed, but peas grow unaffected by IPC.

IPC, like other organic compounds, is broken down and loses its effectiveness under a variety and number of influences. To utilize this weed killer best, users should understand something about its useful properties and then consider those factors in planning application of spray. Users may thus achieve maximum benefits with a minimum of loss.

The most important control considerations seem to include the stage of weed growth (the younger

Below: IPC mixed with dinitro general makes effective pre-emergence treatment for control of grassy weeds in bulb crops. Rows of lilies on left treated with IPC; untreated rows on right overrun with grasses. (Photo by Oregon State College)

the better), stage of growth and tolerance of crops involved, soil temperature and soil moisture, uniform application to soil surface, rainfall or other means of taking the IPC into the soil, soil structure (whether loose or "heavy"), and proper dosage and formulation of materials used.

Loose or open soils generally do not retain IPC as long as other types. Any applications of IPC to loose or sandy soils should be timed closely and applied in such dosages as to effect weed kill quickly before the material is leached or oxidized from the soil. Excessive rainfall may wash IPC from the soil before it has entered the root or seed area, or leach it out too soon after it has been taken into the soil. However, control of annual grasses may be expected, provided that the IPC is held in the soil around the young grass roots, or germinated seed, for a week of moderate weather. Generally, it might be said that from one-quarter to one-half inch of rainfall, or irrigation, may be required to carry sufficient IPC into average soils for best results. As previously mentioned heavy dews or fog may suffice in some areas.

The length of time that IPC remains effective in the soil decreases as the amount used is reduced and soil moisture and temperature increases. Strongly acid soils and soils of high organic content can be expected to require greater dosage of IPC to compensate for deteriorating effects of such soils. Soil temperatures above 70 degrees F. accelerate breakdown of IPC. Applied at rate of four pounds per acre in late fall or early spring, IPC will remain effective under average conditions for 5 to 6 weeks. Exceptional instances have been noted where no grasses appeared for several months following application of 5 pounds of IPC per acre.

IPC does not move laterally in the soil to any extent from the spot where it is applied. For a thorough job it is therefore necessary to distribute required amounts of IPC uniformly over the entire specified surface. If crop foliage such as alfalfa covers the ground, it should be mowed and removed before spraying for grass control. Otherwise sufficient water or other carrier should be used. It should also be remembered that clods of soil in open fields will obstruct proper application.

Crop plants growing or planted in fields to be sprayed with IPC should be inspected carefully by competent agricultural authorities before application, to determine the crop's proper stage of growth. Strawberries, for instance, are tolerant to IPC in dosages greater than would normally be required for weed control. Other crops such as sugar beets and most commercial varieties of flax are generally tolerant to average dosages of IPC only after reaching the four leaf stage. Alfalfa, ladino and alsike clovers, lotus, cane fruits, established woody nursery stock, cranberries, mint, many bulbous crops, spinach, radish, cotton, carrots and others, are quite tolerant to IPC. Before spraying mint with any but the wettable spray powder form of IPC, it should be determined that solvents or other parts of the preparation will not cause off-flavor in the mint oil. This precaution also applies to other crops.

IPC vs ryegrass. Left side of field received no treatment; right side was treated with IPC in February. Note ryegrass has completely choked out clover on left where no herbicide was used, while good stand of clover appears on right side. (Photo by U. of Calif.)

2 Formulations Used

IPC is almost insoluble in water. The technical form as manufactured, is not suitable for use as a spray, so it is formulated into other forms. One such formulation is a wettable powder which can be dispersed in water and sprayed; the other, an emulsifiable liquid which can be mixed with water or oil and applied as a spray. Each form has points of special use and benefit. Generally, the wettable form is somewhat safer to use where crops involved have critical limits of tolerance for IPC. In addition, the wettable form is slightly cheaper to prepare and use. The emulsifiable form on the other hand has the advantage of being a liquid which is easily applied with oil, or with oil and water mixture. However, some good and economical solvents for IPC which are useful in commercial preparation, may also be injurious to certain crops at concentrations of as little as 2 to 3%. Solvents, and other inerts in commercial preparations for selective use with IPC may of their own properties, or in combination with other materials, cause injury to crop plants.

Users are always safer in using products from manufacturers of established reputation, since the latter predetermine possible adverse effects of their materials before offering them for sale.

New Derivative Tried

ONE of the new derivatives of IPC, isopropyl-N-(3-Chlorophenyl) carbamate is undergoing second year field trials in many sections of the country. More than one hundred different formulas have been prepared from IPC and its derivatives by Freed(1) who has probably done more exploratory ground work with IPC than any other investigator. Strictly preliminary reports from several investigators are encouraging regarding the suitability of 3-Chloro IPC for use under higher temperatures than possible with IPC itself. 3-Chloro IPC seems less selective on some crops than IPC, but more effective than IPC on Johnson grass and other weeds. Some crops appear not to be affected by even heavy dosages of the 3-chloro IPC. Sugar beets do not indicate tolerance for the 3-Chloro IPC. Isopropyl-N-(3-Chlorophenyl) carbamate, in pilot plant production only, is a product of a basic manufacturer of IPC(5).

IPC can be combined with certain other weed killing compounds such as 2,4-D, dinitro, penta chlorophenol, calcium cyanamide and others. Before mixing IPC in the spray tank with any other weed killing preparation, it should be determined first that no active or inert material present in either material will interfere with safe and effective use of the combination. As mentioned earlier, solvents, diluents and other agents used in the preparation of commercial weed killers are seldom standardized and may not lend themselves to haphazard combinations. For example: the emulsifiable form of IPC in combination with oil or oil and water, will generally make a better form to use than the 50% wettable IPC, so far as the flowability of the finished dilute spray solution is concerned. Crop tolerance to the oil would have to be considered, of course. Dinitros on the other hand seem equally compatible with combinations of either the wettable or emulsifiable forms of IPC. Calcium cyanamide, as another example, might conceivably react with one or more of the materials present in some emulsifiable preparations and might better be used in combination with the wettable form of IPC if applied in water. Before undertaking new combination sprays of any kind, users should make certain of the propriety of such mixtures by consultation with local, state or federal authorities.

Field Notes on IPC

THE following field notes pertain to a few reports on specific uses of IPC:

Sugar Beets for Seed. Bohnert(6) reports applications of IPC to seed crops of sugar beet rows only, at the rate of 5 pounds actual IPC per acre over the area covered. One application was made in the latter part of September, 1949, when beets were about 3 inches across in the 3-4 leaf stage. A second application of 6 pounds actual per acre, was made one month later by boom sprayer over the entire field. Beet rows previously sprayed received a total of 7½ to 8 pounds actual IPC per acre. Soil is Granite Medium Clay Loam. Weeds completely controlled included ryegrass (*Lolium perrene* L.); "Watergrass" (awnless) sometimes called "Barnyard millet" (*Paspalum sp.*). No visible injury to beets, nor retardation to beet growth was noted. Campbell (7) reports that in the fall of 1949, 53 acres of sugar beet seed fields were sprayed with 50% wettable IPC for control of ryegrass. Only beet rows or one half the fields were sprayed so that beet rows received IPC at rates of 5 to 6.4 pounds actual IPC per acre, at total job costs to growers of $10.00 to $12.50 per acre. "The results have been quite remarkable," he reports, "We observed that following spraying there was some retardation of the beets, but as the season progressed, the difference between the sprayed and unsprayed became insignificant." Campbell's firm sprayed all their contract beet seed acreages in the fall of 1950 with significant saving in labor costs. Carstens(13) Lachman(15) and

(*Turn to Page* 91)

Selectivity of IPC: Left side shows complete control of domestic ryegrass with application of 5 pounds per acre. Spinach developed normally. Heavy growth of ryegrass is seen on untreated side at right. (Photo by Dr. W. H. Lachman, Jr., Mass. Agri. Exper. Station)

Food, Health & Insecticides

FOOD is essential to all productive effort, to health and to life. Insects are one of the main causes of food contamination, food deterioration, food shortages, human disease and death. Thus, insecticides are essential to the production of a bountiful supply of food of high quality. Insecticides must be used to protect foods in transit and storage, and to provide for the comfort and health of man and livestock. Insecticides are also essential to the protection of the nation's forest resources, and our homes and clothing.

World Food Needs

INCREASE in the world population is far outstripping food production. Today the world population is 2¼ billion and on the basis of present population rates of increase, we will have 25 million more people to feed in 25 years than at present. Are we even now producing enough food to prevent extensive malnutrition in many parts of the world and famines that will take hundreds of thousands of lives? The terrible famines of the past may prove to be mild as compared with those which will prevail under adverse crop conditions a quarter of a century hence.

Control Must Continue

ENTOMOLOGISTS, medical men, and engineers, largely through the use of modern insecticides, are doing much to lower the death rate throughout the world. Scientists also have the challenge of keeping food production and population increases in approximate balance. It is claimed that 2.5 acres of arable land is needed to feed and clothe each inhabitant, yet only 1.77 acres is presently available; therefore it is essential that the per-acre production be increased materially.

Due to natural productiveness of soils and scientific discoveries and their application in the United States, people here are surrounded by bountiful food supplies and little realize the part played by insecticides, fungicides, weed killers and fertilizers in providing an abundance of the highest quality of food and fibre that the world has known.

Insects are generally charged with causing tremendous losses. The currently accepted loss-figure is $4,000,000,000 for an average year. This staggering sum is certainly a challenge for entomologists and other scientists to do all in their power to develop new, safe, and practical insecticides. Of the reputed 80,000 different kinds of insects in this country, 6,000 are injurious to crops, fabrics, stored products, forests, wildlife, livestock, and man. The species vary greatly in their habits and mode of attack. Usually several kinds join forces in attacking a crop in production, transport or storage. Therefore, the problem is not only that of developing suitable insecticidal formulations for the protection of all stages of the crop from seed to maturity but, also, during transit and storage under a variety of conditions. Furthermore insects are well known vectors of serious diseases of many plants and animals, including man.

Why Insect Pests Increase

THE impact of insects on agriculture and human economy is difficult to comprehend and to evaluate completely because insects are so interwoven with all the activities of man. Their ravages have been intensified as a result of clearing the land and the growing of agricultural crops in large acreages in different parts of the country. These and other changing practices are inevitable, particularly in times of war, and we must be prepared to meet the insect problems thus intensified. The tendency toward developing a balanced agriculture has resulted in the shifting of cropping systems that have aggravated old insect problems or have created new ones of greater complexity. The failure to rotate crops may induce serious insect problems. The continuous use of land in pasture often fosters outbreaks of white grubs. Some flood control and soil erosion practices favor insect multiplication and their attack on crops. Leaving brush and weeds in fence rows, while favorable for birds and game, may provide breeding and overwintering places for certain pest insects. The impoundment of water frequently provides suitable breeding grounds for pest and malaria-carrying mosquitoes. Thus, the ways in which water or land are used or controlled will have a great effect upon the abundance and destructiveness of

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numerous insect pests. The role that native insects or imported pests may play under new and different ecological conditions in various parts of the country is unpredictable, so the best protection the entomologists can offer to the public is a diversified group of insecticides with which to meet the ever present insect horde.

Pests in Transit, Too

INSECTS not only cause destruction in many ways while the producer is endeavoring to grow a corp, but also, by continued feeding or contamination during transit, in market channels, and in the home. The discriminating housewife of course will not permit worms or plant lice in vegetables nor weevils in the cereals she buys. Hence, unless it is perfectly clean, the product that finally reaches the consumer may be rejected and thrown away. The rigid grading standards in effect eliminate poor quality products and also products with minor blemishes as a result of insect stings or breeding. Such injuries, however, offer a means of entry for disease pathogens that may cause deterioration of the product in storage. Losses from stored product insects are particularly serious because they involve all the cost of production, harvesting, packing, shipping, and storing. These losses are tremendous, for instance, insect damage to stored cereals alone is estimated at $600,000,000 annually in this country.

Carefully executed spray schedules with both insecticides and fungicides insure the public of food products that are not only of high quality but in sufficient abundance to provide a varied diet at a reasonable cost. Only the best reaches the American table, for fruits, vegetables, grains, and other foodstuffs must meet standards set by the Department of Agriculture and the Food and Drug Administration relating to insects and insect debris.

Choice of Insecticides

THERE are a number of reasons why it is essential to have a number of insecticides from which to make a selection for a particular control effort. When a single pest is involved in a given crop, the application of an insecticide highly effective against that particular insect will suffice. However, often more than one pest is present, making desirable the use of an insecticide, or an insecticidal mixture, that will be effective in killing the several pests present, simultaneously. It is also well established that weather, cropping practices, and other factors operating in different parts of the country have a marked influence upon the effectiveness of a particular insecticide. Although plant tolerance is very good for many of the insecticides in current use, some plants can tolerate one material better than another. Therefore a choice of insecticides must be available.

Observations and studies made in different parts of the country have shown conclusively that certain insects, such as the citrus red scale, thrips, codling moth, house flies, spider mites, and mosquitoes have become resistant to certain insecticides. These discoveries are of tremendous importance, particularly when they occur following widespread acceptance and usage of an insecticide as important as DDT. To heed the warning means the further development of new insecticides and effective methods of applying them to control insects that threaten our health and food supply.

Some materials affect beneficial life more seriously than others. Although several new insecticides are quite toxic to fish, one, TDE, at 1 part to 75,000,000 was used successfully to destroy the Clear Lake gnat in a large body of water in California without injury to fish. In other insect control activities care must be taken to protect honey bees if our crops are to be pollinated adequately. Fortunately, only a part of the field bees are affected by certain new materials on legumes, and the control of the pest insects greatly increases the bloom and hence the available nectar supply.

Calcium arsenate, an insecticide of long-standing use, is definitely more destructive to honey bees than the synthetic organic hydrocarbon insecticides. Many of the new insecticides are quite persistent and are destructive to the parasites and predators of certain pest species. As a consequence, DDT and other insecticides used to control the codling moth sometimes result in the development of heavy infestations of the red-banded leaf roller, the apple aphid and two species of red mites which heretofore were considered of minor importance. This situation therefore demands the use of other supplemental insecticides or modification of the spray schedule.

Farmers and entomologists recognize that insect populations are not static but show marked fluctuations in numbers, either seasonally, or periodically, depending upon climate, weather, agricultural practices, and other factors. Insects are no respectors of boundaries as evidenced by the recent widespread spruce budworm outbreaks in Canada and in the United States, and the well known accounts of numerous "locust" or grasshopper outbreaks from biblical to modern times. These outbreaks often are unpredictable, arise suddenly, and therefore require tremendous quantities of insecticides that are not immediately available locally and sometimes not even nationally. For these reasons, it is necessary to resort to any insect killer that will save the crops, even though it may not be the most effective or the most econ-

omical. A wide selection of old and new insecticides at such times is highly desirable.

Public Health Benefitted

THE availability of highly effective new insecticides has made it possible to control many different kinds of disease vectors and to consider the possibility of eradicating certain insect-borne diseases — such as malaria, plague, epidemic typhus, murine typhus and enteritis. In the United States the malaria rate is continually being reduced largely as a result of an intensive control program by the United States Public Health Service and cooperating States involving mainly the spraying of the interiors of homes in malarious areas with DDT.

In other parts of the world—India, Central America, South America, and Italy—reductions of from 30 to 90 percent in the incidence of malaria were obtained that were attributable to effective DDT spraying to control the mosquito vectors.

Another oustanding example of disease control was the stopping of an outbreak of flea-borne plague in Dakar during World War II as a result of the extensive use of DDT on persons, in habitations, and on premises. One of the greatest public health accomplishments recorded was the control of major epidemics of louse-borne typhus in heavily infested populations also during World War II. Most authorities agree that the use of DDT stopped the typhus epidemic in Naples, Italy, and prevented subsequent outbreaks elsewhere in the world.

The cooperative murine typhus control program between the United States Public Health Service and the States also based on the use of DDT, has resulted in an estimated 80 percent reduction of the tropical rat flea, the principal vector of this disease. This control program was started in 1945 and a total of 1,413 tons of 10 percent DDT dust has been applied in 1,105,006 premises treatments in 156 counties of 10 States.

DDT has also been utilized to advantage in the control of diarrheal disease in towns in the lower Rio Grande Valley. It is reported that a significant reduction in the amount of infection, disease and death resulted from the good fly control obtained with this insecticide.

Save Crops

INSECTICIDES, along with other scientific improvements in agriculture, have created a boom in agricultural production. Great increases in crop yields per acre have occurred within the last 20 years— corn is up 36%; cotton, 58%; potatoes, 68%; soybeans, 59%; and oats, 17%. Along with increased yields we have learned to grow better crops.

Insecticides in the form of dusts, sprays, baits, or fumigants have been used to good advantage to prevent, mitigate, or eradicate injurious pests. Improved methods of application, such as in the form of aerosols or spray concentrates from the ground or air, have had an important part in producing increased yields of higher quality crops. Let us consider, briefly, a few examples of outstanding results obtained with some of the potent insecticides developed during the past few years.

In Iowa where heavy infestations of the European corn borer occurred in 1949, corn treated with DDT produced 17½ bushels per acre more than untreated corn.

Field tests in Utah with DDT for control of Lygus bugs on alfalfa grown for seed showed effective control of the insects and resulted in an increase of as high as 135 pounds of seed per acre.

Chlordane and toxaphene have proved highly effective for grasshopper control under a wide variety of conditions. Products have been developed that permit the use of these materials under most conditions without appreciable risk from the residues left on the crops. In view of our experience with these materials, there seems little doubt that they can be used effectively and without creating a health hazard if the minimum necessary doses are used, applications are properly timed, and full advantage is taken of opportunities to kill the pests before they become generally scattered over fields.

Aldrin has been found to be among the most promising of any preparations that have been tested for control of grasshoppers and is rapidly being accepted by the public for combatting these pests. Something above three million acres of crop lands were treated during the 1950 season in the three provinces of Manitoba, Saskatchewan, and Alberta, Canada, and it was used extensively and succesfully, in cooperative State-Federal control programs, and by many farmers in the United States. It has performed equally well on either crop or rangelands. Dosages of 1 to 2 ounces of the technical compound per acre, in one to two gallons of solvent, have generally been found to give excellent control. The total per acre cost for the treatment is on the order of seventy cents.

Parathion was successfully applied to over 500,000 acres of small grains heavily infested with greenbugs in 1950 in Oklahoma, Texas, and Kansas—thus saving the infested grains from nearly total destruction. There was no previously known practical control for this serious pest. Treatments were applied either by commercial operators using aircraft, or by the individual grower with ground equipment. In the 1950 greenbug outbreak alone, this development saved farmers millions of dollars and made available many millions of bushels of needed small grains.

In extensive experimental and commercial scale field tests, ryania, which is the finely ground stems of a tropical plant, was found to be as satisfactory as cryolite for control of the sugarcane borer in Louisana. It was first recommended for grower use for the 1950 crop season and gave good borer control on at least five thousand of the 62,000 acres of sugarcane treated for control of this pest during the progress of the State-supported control program.

The utility of new insecticides was demonstrated in two community-

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Fungicides

Past and Present

by

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A FUNGICIDE is anything that will kill a fungus or its germs (spores); especially any chemical that can be used for this purpose, according to the dictionary. This paper will therefore be limited to those chemical materials that have been, or are now, in common use as sprays and dusts on growing plants for the control of fungus diseases.

Fungicides today, along with insecticides, constitute one of the major weapons in man's continuous war against pests and plant disease. This is a war in which no quarter is asked and none is given. Without fungicides and insecticides, many vegetables and fruits would disappear from the family table and hunger and starvation would be a frequent occurrence even in this land of abundance. Fungicides and insecticides, should therefore be regarded as necessary tools in the struggle for existence and not merely as harmful residues on food, feed and forage crops.

Fungicides for use on growing plants fall into two general classes: (a) protective fungicides and (b) eradicant fungicides. The former, as the name implies, are used in such manner as to prevent the plant from becoming infected; the latter are used after infection to kill the fungus pathogen on and in the tissues of the plant. The ideal fungicides should have both protective and eradicant properties. It should be innocuous and pleasant to use and it should not harm either fruit or foliage. None of the fungicides available to us today have all of these qualifications under all conditions of use.

Both protective and eradicant fungicides are applied as sprays and as dusts. Application as sprays have generally proved more effective than dusts. In many orchard operations, the tendency is to rely on sprays to carry the major burden of protection and to use dusts in supplementary applications when conditions are more favorable for dusting than for spraying. Both dusts and sprays will continue to find their proponents. Both have their place in agriculture.

Much has been said about the relative costs of spraying and dusting. Generally speaking, spray materials are cheaper than their dust equivalents, dosage-wise. However, dusts can usually be applied much more rapidly and at lower costs than sprays. Costs, therefore, may favor either one or the other depending on conditions of use.

With particular reference to sprays, the present trend is toward the use of higher concentrations and lower gallonages per tree or per acre. The introduction of new types of spray equipment has permitted increases in spray concentrations of from two to ten times those in common use. For example, trees that formerly required 20 gallons of dilute spray for good coverage and protection are now being adequately protected with 3 to 4 gallons of concentrate sprays. This has resulted in a saving of time and materials and has lowered spray costs as much as one-third. Concentrate spraying is here to stay.

The present trend toward the use of concentrate sprays is forcing industry to re-examine its products. Some of the products that were formulated for use in conventional sprayers cannot be used advantageously in the new concentrate sprayers. However, many of the fungicides now in use are well suited for application as spray concentrates. Others can be modified with present know-how to fit this new market. The trend in materials will be away from the relatively coarse and bulky wettable powders toward microfine wettable powders, pastes, slurries, solutions, and emulsifiable concentrates. These points will be discussed later with reference to specific products.

Fungicides—18th Century

A REVIEW of horticultural literature reveals that little was known of the science and art of plant disease control with chemicals prior to the beginning of the 19th Century. Fungicides of the 18th Century, if one can call them such, were noted for their offensive odors and other unsavory properties rather than for their fungicidal effectiveness.

A typical fungicide of the late 18th Century was Forsyth's Composition. Lodeman in his book, "The Spraying of Plants" gives its formulation as follows:

*Paper presented before Chemical Engineers Club of Washington, D. C., November 13, 1950.

"Take one bushel of fresh cow dung, one-half bushel lime rubbish from old buildings, one-half bushel wood ashes, one sixteenth bushel pit or river sand. The last three are to be sifted fine before they are mixed. Then work them well together with a spade, and afterward with a wooden beater until the stuff is very smooth, like fine plaster used for the ceiling of rooms."

Either soap suds or urine was used to make the composition of the consistency of plaster or paint. After being applied, it was covered with a sifting powder made of "dry powder wood ashes, mixed with the sixth part of the same quantity of the ashes of burnt bones."

Forsyth's Composition was recommended to cure diseases, defects, and injuries of plants. It was held to be particularly valuable in promoting the healing of wounds, and was commonly used to fill the cavities in trees. The ingredients were apparently standard remedies at that time and they persisted long after his composition went out of use.

Fungicides—19th Century

Sulfur. References to the use of sulfur as a fungicide date back at least to 1821. In November of that year a John Robertson told the London Horticultural Society that sulfur was the only specific remedy that could be named for the treatment of mildew on peaches. He advised that it should be mixed with soap-suds and applied by dashing it violently against the trees by means of a rose syringe. He told his listeners that it was necessary to sprinkle all parts of the tree with the mixture to be sure of success. This is still good advice today and elemental sulfur, in finely divided form, is still one of our standard remedies for use against the powdery mildews on fruits, vegetables and ornamental plants.

For purpose of record it should be noted that in the treatment of the powdery mildews on growing plants, elemental sulfur serves both as an eradicant and also as a protective fungicide. For most uses we think of elemental sulfur primarily as a protective fungicide.

Lime-Sulfur. It was natural that sulfur should be used in combination with many other materials. Some of these were reaction mixtures. One of them was a mixture of sulfur and quicklime heated together in the presence of water to form the water-soluble polysulfides. References to such compositions can be found in horticultural literature dating back at least to 1833. Some of these mixtures undoubtedly owed much of their fungicidal potency to their polysulfide content. Like sulfur they were used during this period primarily for the control of the powdery mildews.

Commercial lime-sulfur solution, as we know it today, found its way into our spray programs by way of Australia to California where it was first used as a sheep dip. When San Jose Scale invaded California's peach orchards, lime-sulfur sheep dip was tried as a scalicide on peach. It controlled not only the scale, but peach leaf curl as well. Lime-sulfur solution thus became our first eradicant fungicide. This all happened about 1886.

San Jose and liquid lime-sulfur both migrated east from California. Lime-sulfur continued to be used solely as an eradicant dormant spray until about 1905 when it was tried on apples in the summer sprays for the control of scab. Its performance was so outstanding as an eradicant and as a protective fungicide, that it practically displaced bordeaux mixture as an apple scab spray by 1910.

Lime-sulfur solution is still one of our standard fungicides in spite of all efforts to displace it. Industry doesn't like it because it can't be made and sold at a reasonable profit, apple growers don't like it because of its drastic effect on foliage and fruit. However, it will control scab when many other things fail, and it is cheap. For these reasons it will probably be with us as a fungicide for many years to come. Its place among the new concentrate sprays is yet to be determined.

Copper. The value of copper as a fungicide for use on growing plants was first noted in France in 1882. At that time a reaction mixture of copper sulphate and quicklime in water was being used by some grape growers to protect their crops from thievery. The mixture was dashed by means of a whisk broom onto the vines adjacent to paths and roadways. Poison signs were erected. The prominent blue residue, together with the sign, not only frightened off mischievous boys bent on raiding the vineyards, but it also controlled the downy mildew of grapes. Bordeaux mixture, as the compound was called subsequently, soon gained general recognition as a protective fungicide for use on growing plants.

Bordeaux mixture found its way from France to the United States about 1887 where it was greeted with considerable enthusiasm by growers and agricultural authorities alike. It was the first good protective fungicide and, in the absence of any real competition, it was used on everything — fruits, vegetables, and ornamentals—for both real and imaginary ailments. Needless to say, it has stood the test of time and, in its many forms, it still holds a prominent position in our modern spray progress. Like lime-sulfur solution it is too drastic in its effects on some plants, but it is an effective fungicide. In spite of increasing competition from other copper fungicides and from the new organic fungicides, bordeaux mixture will probably have a long and honorable future. Its role as a concentrate spray is yet to be determined.

Fungicides—1900 to 1950

FROM the time of their introduction until about 1930, bordeaux mixture and lime-sulfur continued to dominate our agricultural fungicide markets. During this same period growers were becoming acquainted with both the faults and virtues of these materials. Both materials were excellent fungicides, neither was pleasant to use, and both were injurious to foliage and fruit under some conditions of use. A growing demand for safer fungicides was soon felt.

The introduction of self-boiled lime-sulfur by Scott in 1908 gave a satisfactory product to the peach growers temporarily. It was made by slaking together 15 pounds

of quicklime and 10 pounds of finely divided sulfur in a small amount of water with constant stirring and then quenching the batch with more water as soon as yellow streaks of polysulphides began to show in the mixture. The entire batch was further diluted with water to make 50 gallons of spray. Needless to say it was messy to make and difficult to apply. Growers soon were demanding something "just as good" but less messy and easier to use. They got it in 1923—or thought they did—in a physical mixture of finely ground sulfur, hydrated lime and calcium caseinate called "New Jersey Dry Mix."

This material kept the peach growers quiet for several years, but it was bulky and difficult to apply and was used at rates up to about 33 pounds per 100 gallons. It wore out spray pumps and nozzles and, because of its hydrated lime content, it deteriorated rapidly in storage. Manufacturers solved the problem by leaving the lime out of the mixture and substituting other wetting agents for calcium caseinate. The market was shortly flooded by a multitude of "wettable sulfurs". They differed in names and claims but most of them had one thing in common. Their basic ingredient, sulfur, was ground to a fineness such that 98 to 100% of it would pass a 325-mesh screen.

The 325-mesh wettable sulfur proved to be a valuable addition to the spray material supply. They were less drastic in their effects on foliage and fruit than lime-sulfur, but they were also less effective as fungicides. They are well adapted for use in conventional sprayers but cannot be used advantageously in the new concentrate sprayers.

Colloidal Sulfurs

FAILURE of the 325-mesh sulfurs to control diseases like apple scab to the satisfaction of the growers, led to a search for equally safe but more effective sulfurs. Research indicated that a solution to the problem might be found by grinding or otherwise subdividing sulfur to colloidal fineness. Several such products were introduced to the hopeful trade. None of them lived up to expectations. Their performance in the laboratory far exceeded their performance in the field. At economic dosages they failed to control apple scab; at effective dosages they were priced off the market. The colloidal sulfurs as agricultural fungicides died aborning. However, the present trend toward the use of concentrate sprays may revive them.

Microfine Sulfurs

MICROFINE sulfurs took over where the colloidal sulfurs left off. Intermediate in fineness between the colloidal and the 325-mesh products, they were cheaper to make than the former and more effective than the latter. They have come to stay.

Flotation sulfur paste, a by-product of the coke industry and one of the first of the microfine products, was introduced for limited sale here in the east in 1931. It was offered for general sale to fruit growers the following year. In some areas it rapidly replaced liquid lime-sulfur in the scab sprays on apples. It was competitive in price and caused less foliage injury than lime-sulfur. Application for application, however, it was not the fungicidal equal of lime-sulfur. It lacked the eradicant effect of the polysulfides. This weakness of flotation sulfur was compensated for by shortening the intervals between applications which produced as good control of apple scab as was possible with lime-sulfur. It took more sprays to do an equal job of scab control; the reward was better foliage and more U. S. No. 1 fruit. Generally, the reward more than compensated for the higher spray costs.

Many brands and several new types of microfine sulfur soon appeared to challenge flotation sulfur. Few of them were as effective in scab control as the best flotation sulfur pastes; none were appreciably better. Most of them were not as fine.

Other things being equal, the sulfur with the finer particles usually excels in scab control. However, fineness alone does not account for some of the observed differences in the effectiveness of microfine sulfurs. To perform well under conditions favorable to apple scab, a fungicide must set up quickly into an adherent residue even though only partially dried. Usually, the paste or slurry forms of sulfur set up more quickly and adhere more tenaciously than do the microfine wettable powders. For this reason, the paste sulfurs have been recommended preferentially over the microfine wettable powders for use during periods of frequent and heavy rains. Paste sulfurs generally find their preferred market in the early season sprays on deciduous fruit when their quick-setting and tenacious properties are most useful. Later in the season, with the approach of hot weather, a less tenacious material may be more desirable.

All elemental sulfur sprays and dusts will injure certain plants in hot weather. Liquid lime-sulfur will injure certain plants both in cool and in hot weather. For this reason it is not uncommon for the apple grower to substitute a paste sulfur for liquid lime-sulfur in the pink, blossom, petal fall and first cover applications and then to substitute a microfine or a 325-mesh wettable sulfur for the paste in the second and later covers. Or in areas where injury from sulfur is a frequent occurrence in the summer months, he may use either a low-soluble **(fixed)** copper or one of the new organic fungicides in the second and later cover sprays. Such is the trend today.

Fixed Coppers

IN making bordeaux mixture, a solution of copper sulfur and a slurry of hydrated lime are mixed together to form a low-soluble or "fixed" copper precipitate. The nature of this precipitate varies as the proportions of copper sulfate and hydrated lime are varied. The best information today indicates that the initial product of the reaction between copper sulfate and calcium hydroxide at ordinary temperatures is a basic copper sulfate. This product is formed when less than 0.75 equivalent of calcium hydroxide has

(*Turn to Page* 101)

Problems similar to those faced by U. S. Control Officials are discussed by Belgian authority on

Pesticide Control Problems

FEW people today doubt the necessity of defending vegetable crops against attacks of insects and plant disease which are always ready to destroy such crops, particularly when the practice of plant protection presents such a strong case in its favor. Of all agricultural problems, that of plant protection appears to present many complexities not found in many other spheres of activity.

It has not been long since the only economic poisions available to growers of vegetables and fruit, were sulfur (in the form of lime-sulfur mixture), a few copper salts, the arsenicals, tar oils, nicotine and maybe some other rather elementary insecticidal and fungicidal compounds. In the past 20 years, however, the number of agricultural chemicals has increased, and in Belgium, as in many other countries, we have on hand a range of control chemicals both large and complete.

Due to the tremendous increase in these activities since 1930, a new term has been coined to describe the work done on plants via various chemical applications. This term, "Phytopharmacy," includes the pharmacy of all products used in parasite control, such as insecticides, and in general all chemicals used for protecting plants against such enemics attacking them.

Such an upsurge of chemical uses naturally attracted the attention of chemical manufacturers who began research in the field of chemical synthesis to bring out more and better compounds to be used in "Phytopharmacy." Some of these research results attracted world-wide attention; but in the beginning, there were questionable products being put on the market. These included many so-called "secret" or "proprietary" brands which, in spite of catchy trade names, were unsatisfactory in actual use after being marketed and sold.

In view of these activities, it appeared that stricter regulations would be necessary to act as a brake on certain abuses in the industry. Thus, a few months before World War II began, negotiations began between a number of European countries with the hope of arriving at an international standardization of agricultural chemical products, including their chemical and biological testing methods.

On account of the extraordinary growth in the number of products and in order to protect the interests of farmers and growers, an official regulation of the trade has been decreed and established in Belgium since 1942. The measure was decided to secure a constant and satisfactory value of the insecticidal and other specialties marketed in the country.

Article I of this decree, which has been further confirmed on January 28th, 1946 (decree presently subject to revision of its modes of execution, however unchanged as to the principles of applications), reads as follows:

"The insecticides, fungicides, herbicides and antiparasite materials grouped as phytopharmaceuticals, designed to prevent or to control the growth of animals or vegetables injurious to agriculture, cannot be presented for sale, stored with the intent of sale nor transported with an intent of sale, except after previous authorization has been granted by the Minister of Agriculture, at such conditions as will be determined by him for each material. Each material admitted for sale is registered at the Government Station of Phytopharmacy at Gembloux."

In accordance with this decree, every material, before entering the Belgian market, has to submit to a complete examination by the above station.

Anyone, deciding to present such a product for sale in Belgium, has first to fill out a form mentioning his name, address and trade name; and second, to supply an exact description and the contents in active ingredients and all components of his products, the use for which they are intended, as well as the dosage and methods of use. This includes, the percentage composition of each material specified in volume or weight, and the description of all the active elements, carrier, wetting or auxiliary agent, etc., each component to be defined by its chemical formula and its trade name.

Communication of such composition is confidential and it is kept locked in the files of the station. It can be made in a sealed cover bearing the inscription: "Phytopharmacy—Secret."

The Station of Phytopharmacy then proceeds to a three-fold check of each material:

1. **Chemical analysis: an examination in order to determine the contents in active ingredients and eventually to trace dangerous elements, such, for instance, as could have phytocidal effects;**
2. **Physico-chemical tests: to check particle size, wetting power, stability of the emulsion, of the suspension, etc.;**
3. **Biological tests: in the laboratory (in-vitro) and in the field.**

At this stage the data obtained from these various tests are centralized, discussed, and if the material has given satisfaction in all these tests,

by

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Director of the Government Station of Phytopharmacy, Gembloux, Belgium

it is entered in the registers kept at the station, under its given number. This number, in the future, will follow the material wherever it is commercially transacted and will always figure next to trade name on labels and other labeling.

For the well-known and the elementary materials, the examination can be a short one; for certain materials even a chemical analysis and a simple physico-chemical test are sufficient, either to authorize or to reject a material.

However, if the material contains active materials, little known or relatively novel, either as to their activity on parasites or the secondary effects on the host plant, the examination may require much more time. It often appears that even the laboratory tests are insufficient and that field tests are required. This sometimes makes for some difficulty, as it is not always possible to assess the actual value of a material in one season.

The official list of authorized materials is regularly published in the "Moniteur Belge" (being the official publication of the Kingdom) and a brochure has recently been issued, in which all materials authorized for sale as of December 31st, 1949, is listed.

It cannot be denied that a number of factors play a part in determining the value of these materials and that, these factors themselves being exposed to change, a change in the efficiency of the material is of course possible.

As far back as 1935, at the meeting of the International Congress of Agricultural Industries at Brussels, Belgium, a resolution was adopted asking for a study of the standardization of insecticides and fungicides and of the methods for evaluating their practical value.

To enact this resolution, in 1936 a committee was named in Paris, with the title of "Committee for Standardization of Fungicidal and Insecticidal Products," under the chairmanship of Dr. Ch. J. Bernard. The committee was instructed to bring about, in the shortest possible time, the cooperation of expert individuals, and to present a preliminary report on the ways and means of achieving its aims.

This committee, of which the author was a member, held one more meeting in Scheveningen, Netherlands, in 1936 and one in Budapest in 1939, coinciding with the convention of the Agricultural Industries. Its activity was suspended by the war, and started again in 1947, when the Congress met in Paris under the chairmanship of Dr. Bernard.

At this meeting a resolution was adopted to promote the creation of an international body to study the antiparasite materials and to originate steps to this effect with the F. A. O.

The problem kept on growing and as "Phytopharmacy" has now come into its own as a separate scientific discipline, it became the more urgent to combine all efforts toward an international agreement, covering regulation of the trade, standardization of the products and normalization of testing methods.

The activity of the international organization would be directed toward the coordination of all former, often unrelated, efforts for the foundation of a central organization, international in scope, which would be in charge of these problems. It would not only promote the standardization of analytical and control methods, but also cover a general study of phytopharmaceuticals. Chemical, physico-chemical and biological test methods would be investigated, in order to make them constantly reproducible and resulting in comparable data. Agreement would be desirable even on the denomination of the materials and their trade names, in a way similar to the one adopted in the U. S. by the Interdepartmental Committee on Nomenclature.

As for the part of Belgium, the Station of Phytopharmacy recently completed a number of chemical and biological control methods. It would be desirable if other countries studied the various methods and adopted a standard process for use on similar work.

Visits by the author to the various experiment stations and a number of research laboratories in the United States have indicated that all the methods are rather close and that only a slight effort would be required to arrive at unique standard methods, fit for exact reproduction, in all cases.

Under the sponsorship of the International Federation of Agricultural Engineers and Technicians (C. I. F. A.) an international convention gathered in Rome, Italy last year to study plant parasite control materials. Included in its program was a report on the most recent scientific conclusions in the field of antiparasite materials, as well as on the latest methods used in the control of plant parasites.

On the same occasion the outlook for standardizing regulations required for recognition of antiparasite materials was discussed, as well as the chances for standardizing biological laboratory and field techniques, and the chemical methods for the analysis of a agricultural control chemicals.

These facts certainly show that a movement is on its way to promote an understanding on the problems related to the evaluation of plant control chemicals.

More effective international cooperation would thus be advisable, with a view of achieving unity in conventional methods, although need for a different method remains for each type of material subject to examination. However, if the specialists pool their methods, there is no doubt that a standardized method, as an element of an international code, could be selected for each case, on which general agreement could safely be expected.

Price relationships of certain

Nitrogen Fertilizer Materials[1]

by

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PART I

Historical Background

DURING the Nineteenth Century the cheapest nitrogen suitable for fertilizer use was in the form of industrial by-products of plant or animal origin, such as cottonseed meal, fish scrap and tankage. In 1900, 91 percent of the nitrogen in commercial mixed fertilizers was derived from natural organics. Since then profound changes have occurred in sources of nitrogen for making mixed fertilizers, as seen in Table 1. These changes were accompanied or preceded in every case by alterations in the price relationships of the different materials available. (See Table 2.)

With the development of the mixed feed business from 1900 to 1920, the price of nitrogen in natural organics increased, until it exceeded that of any chemical form.

Around 1910, nitrogen in ammonium sulfate became the lowest priced form. Calcium cyanamid was introduced in 1910 and in a short time it became the cheapest source of nitrogen and remained so until 1925.

Between 1921 and 1931, 11 synthetic ammonia plants were built in this country. One was later abandoned, but in 1934 the combined production capacity of the other ten was 344,000 tons of nitrogen annually. This capacity remained about the same until the beginning of world War II.

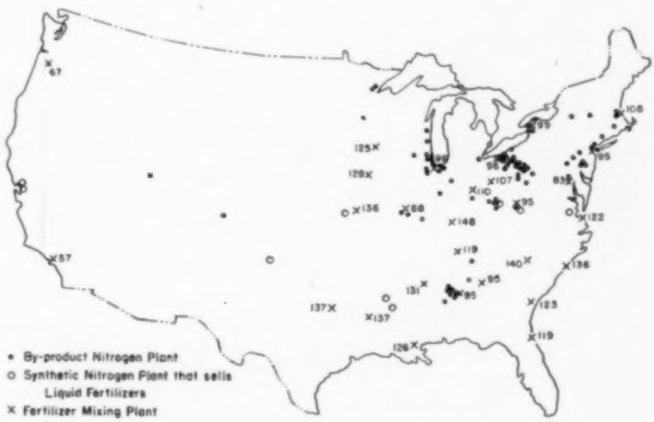
In the spring of 1940, a new era of development of synthetic ammonia production facilities began. Most of the old plants were enlarged and 12 new ones were built. Most of this development occurred in the three years from 1941 to 1943, inclusive. At present, the annual capacity of the United States to fix atmospheric nitrogen has increased to about 1,400,000 tons.

Both periods of expansion in the synthetic ammonia industry resulted in lower prices for anhydrous ammonia. In 1926, free ammonia became the cheapest source of combined nitrogen at $1.75 per unit of 20 pounds, F. O. B. plant. This was the first time in the history of the industry that any form of nitrogen had ever been regularly quoted at less than $2.00. At that time the average prices on the same basis for ammonium sulfate, sodium nitrate, and 4 organics were $2.52, $3.27 and $4.62, respectively. In 1945, the price of nitrogen in ammonia form dropped to 72 cents per unit.

Free Ammonia as Fertilizer

AMMONIA is not as convenient to use in making mixed fertilizers or to apply to soils as other materials commonly employed. It is a gas at ordinary temperatures, which even when diluted with much air

Figure 1



Difference in delivered cost of nitrogen in the form of Ammonium Sulfate and Liquid Forms in 1949 in cents per unit of 20 pounds of N.

1 Presented before the Fertilizer Division at the American Chemical Society Convention in Chicago, Ill. Sept. 5, 1950.

remains very irritating to eyes and throat. When liquified, it exerts a high vapor pressure. Thus special equipment is necessary to store, transport and use anhydrous ammonia.

Because of the big savings in cost that could be made after the development of the synthetic ammonia industry, ways of using ammonia in manufacturing fertilizers developed rapidly. Superphosphate contains free acid and monocalcium phosphate, which react readily with free ammonia. Other reactions also occur with further absorption of ammonia. However, only a part of the nitrogen required to manufacture mixed fertilizers can be derived profitably from free ammonia. Thus no matter how cheap ammonia becomes, other sources of nitrogen must also be utilized.

Ammonia can be transformed readily into solutions containing ammonium nitrate or urea and ammonia in water. Compared to the cost of making these solutions, it is expensive to prepare the solid chemicals in satisfactory condition for fertilizer use. Fortunately, the solutions can be utilized directly in the manufacture of mixed fertilizers. They began to be so used about 1933.

Nitrogen solutions and urea-ammonia liquors contain around 20 percent free ammonia and have very low vapor pressures as compared with anhydrous ammonia. The heat of reaction with superphosphate is sufficient to drive off some water. When this is done in a rotating drum the mixture is more or less granulated, which improves drillability. Thus physical conditions are benefited at the same time nitrogen is obtained more cheaply than would be possible if it were purchased as a dry material.

Anhydrous Used Since '34

THE use of anhydrous ammonia directly in agriculture began in 1934 in California. For a long time it was used only as an addition to irrigation water. In the past few years, however, methods have been developed for applying it also directly in soil. This usage is growing rap-

Table 1

Portions of nitrogen in commercial mixed fertilizers in several forms

Calendar year	Ammonia and its salts [1] *Percent*	Nitrates [1] *Percent*	Natural organics *Percent*	Organic chemicals *Percent*
1900	2.1	6.9	91.0	0
1909	16.1	16.2	67.7	0
1919	23.8	19.7	53.6	2.9
1929	48.2	19.0	22.2	10.6
1939	58.2	15.6	15.3	10.9
1945	72.1	13.4	7.6	6.9
1946	72.8	15.1	5.4	6.7
1947[2]	71.6	17.4	5.1	5.9
1948[2]	73.8	16.0	4.5	5.7
1949[3]	79.5	12.0	5.5	3.0

[1] One-half of the nitrogen of ammonium nitrate is included under ammonia and one-half under nitrates. The urea N content of urea-ammonia-liquor is included with organic chemicals.
[2] Revised.
[3] Preliminary

Table 2

Average wholesale prices [1] per unit of 20 pounds of nitrogen in various materials at producing points or ports in bulk car lots.

Year	Ammonium sulfate [2]	Anhydrous ammonia [2]	Calcium cyanamide	Sodium nitrate Imported	Solutions [3] Average [2]	Urea 42%	Natural organics [4] Average
1900	$2.79	....	....	$2.37	....	....	$2.57
1905	3.01	....	....	2.97	....	....	2.88
1910	2.64	....	$3.43	2.76	....	....	3.63
1915	3.09	....	2.54	3.04	....	....	3.54
1920	4.08	....	3.40	4.44	....	....	8.71
1925	2.65	....	2.20	3.28	....	....	4.88
1926	2.52	$1.75	2.19	3.27	....	....	4.62
1927	2.33	1.63	1.95	3.22	....	....	5.25
1928	2.27	1.54	2.01	2.88	....	....	6.13
1929	2.01	1.46	1.90	2.78	....	....	5.22
1930	1.79	1.40	1.65	2.49	....	....	4.50
1931	1.34	1.36	1.38	2.36	....	....	2.90
1932	1.02	1.34	1.08	1.86	....	....	1.83
1933	1.12	1.15	1.13	1.53	$1.06	....	2.64
1934	1.18	1.09	1.20	1.54	1.02	....	3.41
1935	1.13	1.09	1.20	1.47	1.07	....	3.38
1936	1.17	1.09	1.21	1.55	1.05	....	3.52
1937	1.32	1.09	1.26	1.64	1.17	$1.52	4.49
1938	1.36	1.09	1.29	1.68	1.22	1.37	3.52
1939	1.33	1.09	1.16	1.68	1.22	1.34	3.72
1940	1.37	1.09	1.20	1.68	1.22	1.32	3.55
1941	1.41	1.09	1.22	1.69	1.22	1.32	4.05
1942	1.43	1.09	1.44	1.74	1.22	1.37	4.70
1943	1.42	1.09	1.44	1.75	1.22	1.37	4.82
1944	1.42	.91	1.44	1.75	1.11	1.37	4.82
1945	1.42	.72	1.44	1.75	1.07	1.37	4.85
1946	1.44	.72	1.64	1.97	1.04	1.37	7.11
1947	1.60	.72	1.98	2.50	1.03	1.39	9.71
1948	2.03	.80	2.56	2.86	1.14	[5]1.80	8.93
1949	2.29	.94	2.82	3.15	1.23	[5]2.01	8.45
1st half 1950	2.10	.91	2.26	3.00	1.23	[5]1.94	8.60

[1] Computed largely from published quotations in the Oil, Paint and Drug Reporter. The earlier quotations for cyanamid, ammonia, solutions and urea were supplied by the producers. These prices are for spot purchases. Contract prices are lower than those given here. Quantity discounts are also given.

[2] Freight equalized 1926 to 1946, inclusive. Not equalized thereafter. This means that prior to 1946 producers adjusted prices to individual points so that the delivered price was the same as that of one or more competitors products at the same point.

[3] Nitrogen solutions and urea-ammonia-liquor.

[4] 1900 to 1932 inclusive: Fish scrap, animal tankage, dried blood and cottonseed meal. 1933 to 1949: Castor pomace, process tankage, fish scrap, cottonseed meal and animal tankage. An allowance has been made for the P_2O_5 and K_2O, where present.

[5] Quoted since Feb. 22, 1948 only on a delivered basis. An allowance of 20 cents per unit is made for this in the price given here.

idly, especially in the south and west.

In 1928, 14,000 tons of ammonia liquor containing 2,900 tons of nitrogen was used in making mixed fertilizers. By 1935, consumption of liquids had expanded to 5,000 tons of ammonia liquor, 13,500 tons of anhydrous ammonia and 25,000 tons of solutions, containing a total of about 16,500 tons of nitrogen in the form of free ammonia. In the year ended June 30, 1949, 170,000 tons of free ammonia were used in making mixed fertilizers and 69,000 tons were applied directly to soils and irrigation water. The total is approximately equivalent to 197,000 tons of nitrogen, equivalent to the total consumption in all forms used in 1932.

Although many different materials are used locally as sources of nitrogen in the manufacture of mixed

(Turn to Page 81)

Table 3

Actual delivered costs [1] of nitrogen per unit in various forms in several periods of time, by regions and localities

Locality [2] and Region	5-year aver. 1935-39		5-year average 1940-44			3-year average 1945-47			1948			1949		
	Solutions [3]	Ammonium sulfate	Solutions [3]	Ammonium sulfate	Ammonium nitrate	Solutions [3]	Ammonium sulfate	Ammonium nitrate	Solutions [3]	Ammonium sulfate	Ammonium nitrate [4]	Solutions [2]	Ammonium sulfate	Ammonium nitrate [4]
New England														
Boston, Massachusetts	....	$1.33	$1.23	$1.51	$1.76	$1.20	$1.57	$1.64	$1.29	$1.87	$2.18	$1.50	$2.58	....
Middle Atlantic														
Carteret, N. J.	$1.18	1.21	1.22	1.40	1.41	1.15	1.47	1.72	1.35	2.06	....	1.40	2.35	$2.61
Baltimore, Md.	....	1.29	1.22	1.40	....	1.11	1.47	....	1.36	1.99	....	1.45	2.23	....
Buffalo, N. Y. and Charlestown, W. Va.	....	1.27	1.26	1.40	1.42	1.11	1.48	1.54	1.13	2.01	2.00	1.32	2.29	2.45
South Atlantic														
Norfolk, Va.	1.20	1.38	1.21	1.47	1.50	1.09	1.57	1.49	1.19	2.31	2.75*	1.23	2.45	....
Wilmington, N. C.	1.00	1.23	1.21	1.42	1.51	1.15	1.40	1.54	1.30	2.62	1.99	1.31	2.67	2.05
Savannah, Ga.	1.18	1.21	1.21	1.39	....	1.10	1.73	....	1.19	2.64	....	1.43	2.66	....
Jacksonville, Fla.	1.20	1.23	1.23	1.41	1.67	1.16	1.57	1.56	1.40	2.44	1.83	1.45	2.64	2.05
Spartanburg, S. C.	....	....	1.31	1.54	1.59	1.21	1.69	1.61	1.23	2.33	1.95	1.38	2.78	2.20
Atlanta, Ga.	1.06	1.26	1.28	1.43	1.62	1.21	1.62	1.58	1.39	2.34	1.87	1.41	2.36	....
East North Central														
Columbus, Ohio	....	1.27	....	1.39	....	1.12	1.49	....	1.25	2.18	....	1.43	2.46	....
Chicago, Ill. and Sandusky, Ohio	....	1.21	1.28	1.44	1.46	1.18	1.53	1.59	1.30	2.08	2.01	1.35	2.31	2.09
East St. Louis, Ill.	....	1.22	....	1.41	1.38	1.22	1.48	1.57	1.33	2.08	1.76	1.46	2.34	2.01
West North Central														
Mason City, Iowa, Perry, Iowa and Kansas City, Mo.	....	....	....	....	....	1.22	1.90	....	1.24	2.49	1.73	1.45	2.86	1.89
East South Central														
Louisville, Ky.	....	....	1.02	1.44	....	1.16	1.57	....	1.37	2.53	....	1.47	2.85	....
Nashville, Tenn.	1.04	1.27	1.33	1.46	1.51	1.20	1.64	1.51	1.37	2.52	1.99	1.39	2.58	2.05
Birmingham, Ala	1.06	1.23	1.32	1.40	1.61	1.14	1.46	1.52	1.30	2.01	1.76	1.45	2.40	2.06
Tupelo, Miss. and New Orleans, La.	....	....	1.31	1.45	1.77	1.20	1.57	1.47	1.38	2.31	1.69	1.59	2.76	1.97
West South Central														
Shreveport, La. and Dallas, Texas	....	1.48	1.41	1.64	....	1.29	1.83	1.50	1.42	2.61	1.67	1.44	2.81	1.96
Western														
Los Angeles, Calif.	....	....	....	....	....	....	2.14	1.87	....	2.45	2.22	1.79	2.69	2.27
Average Delivered	1.12	1.27	1.25	1.44	1.56	1.17	1.60	1.57	1.30	2.31	1.98	1.43	2.57	2.13
Average F.O.B.[5]	1.14	1.26	1.20	1.41	1.38	1.05	1.48	1.38	1.14	2.03	1.71	1.23	2.29	1.73

[1] As reported by one or more companies. Blank spaces in the table indicate that none was bought by reporting companies in the period involved or that records are not now available.

[2] The plants for which reports were received were not always in the city named but were in that area.

[3] Whatever liquid form of nitrogen was used. The same company in a number of cases used several different types during the period under review. The prices of Nitrogen Solutions and Urea-Ammonia-Liquor have usually been about the same and those of anhydrous and aqua ammonia considerably less in the same period.

[4] After July 1, 1948 regulations issued by the Interstate Commerce Commission prohibited bulk shipment. The F.O.B. quotations after this date are for bagged material.

[5] At points of production. The solution data are spot prices for Nitrogen Solutions and Urea-Ammonia-Liquors. The ammonium sulfate prices are average of the weekly quotations in the Oil Paint and Drug Reporter. Those for ammonium nitrate are averages of data provided by American Cyanamid Co., Consolidated Mining & Smelting Co., Ltd., Tennessee Valley Authority, Spencer Chemical Co. and Hercules Powder Co. The ammonium nitrate prices have been more variable than the others. For example in 1948 and 1949 they were as follows:

	1948	1949
Welland, Ont. Canada	$2.32	$1.87
Trail, B. C. Canada	1.56	1.61
Sheffield, Ala.	1.48	1.63
Parsons, Kansas	1.46	1.79
Pinole, Calif.		1.74

World Consumption of Pesticide Materials

PART 1

N[illegible] since the beginning of ch[illegible] pest control in the prev[illegible] century was consumption and [illegible] of products employed so great as [illegible]. Prior to World War II, the [illegible] of world consumption consisted [illegible] such standard inorganic chemicals as calcium arsenate, lead arsenate, paris green, cryolite and other sodium compounds, copper sulfate, and sulfur. Some quantities of nicotine sulfate, rotenone, pyrethrum, and other botanicals also were employed.

The inauguration of DDT in World War II was the beginning of a trend toward use of synthetic organic pest control chemicals. The availability of the chemicals needed for their manufacture in most industrialized countries is one of the advantages of such use. On the other hand, many areas have to import arsenic; cryolite is obtained only from Greenland; rotenone-containing roots are confined to South America, Far Eastern, and Africa countries; and present sources for pyrethrum flowers are largely British East Africa and Belgium Congo.

Millions of dollars have been spent by industry in research on organic chemicals for use as pest control materials. Considerable sums have been spent by both industry and Government departments for carrying out entomological and toxicological tests on these compounds, to determine their efficiency against insect pests and plant disease[illegible] and the effect on vegetation, as well as the degree of toxicity to h[illegible]ans and animals partaking of the treated crops.

[illegible] use of DDT as an insecticide was for control of the Colorado beetle in Switzerland; moreover, it proved valuable for louse control in World War II. Further tests proved its efficacy in garden sprays, and as an agricultural insecticide. In 1947, benzene hexachloride began to compete seriously with DDT for numerous uses, and soon other organic pesticides followed. Among the new synthetic organic pesticides are 2,4-D; chlorinated terpenes; various chlorinated hydrocarbons; phosphatic compounds (hexaethyl tetraphosphate, tetraethyl pyrophosphate, and the thiophosphates); organic soil fumigants; various new rodenticides — "ANTU," "1080" and warfarin; new fungicides such as dithiocarbamic acids and salts; the quaternary ammonium compounds as disinfectants; and the newest of all, allethrin.

by

Laura G. Arrington

U. S. Department of Commerce
Chemical Division

The World-wide trend in consumption of pest control chemicals is definitely toward the organic compounds, and use of the other products has begun to decline and may continue to do so although consumption will not cease. World consumption of DDT in the years immediately following World War II was particularly heavy, largely because of its introduction in areas where pesticides had been unknown up to that time. Many industrialized countries now manufacture one or more of the new pesticides to meet demand, which is heavier than for the traditional materials. In other countries, imports of pest control chemicals have risen, with the result that U. S. exports of these commodities have outstripped those of older products (see table).

Following is available information on the trend toward greater use of organic pest control chemicals in various areas of the world.

North America

THIS continent is the world's largest producer and consumer of pest control products and manufactures the greatest variety of such commodities. North American countries also provide the largest market for U. S. exports of these commodities, rising from $1,854,000 in 1939 to $10,034,000 in 1949 ($8,500,000 in January-June 1950). Organic materials exported to this area in 1949 were 66 percent of total shipments,

compared with 45 percent in 1939; in the first half of 1950 they equaled 82 percent.

United States—The U. S. is the largest producer and consumer of pesticides of all sorts. According to the Census of Manufacturers, in 1947 output of pest control products (including disinfectants) totaled around $130,000,000, almost three times the $45,000,000 reported in 1939; 1949 production is estimated at $150,000,000. In 1947, 85 percent of reported output consisted of what might be termed organic products; comparable figures for 1939 are unavailable.

Output of DDT was first reported in 1944 when 9,626,000 pounds were manufactured. By 1947 this figure had risen to 49,000,000 pounds. In 1949, production dropped to 38,213,000 pounds; however, January-June 1950 output was at a much higher rate — 27,020,000 pounds — largely because of heavy domestic and export demand for control of cotton insects. BHC production in 1947 was 8,197,000 pounds, but rose to 26,736,000 in 1949, and in the first half of 1950 closely approximated that for the entire preceding year — 23,566,000 pounds. 2,4-D has come into popularity as a weed killer since 1945 when 917,000 pounds were produced; output rose to 27,309,000 pounds in 1948, and increased still further to 27,957,000 pounds in 1949. The only other synthetic organic material used as a pesticide on which production data are available is dithiocarbamic acid and salts, output of which rose from 3,991,000 pounds in 1947 to 8,100,000 pounds in 1948 (1949 data not available). However, a large undetermined percentage of output is used in rubber processing.

In contrast, output of inorganic pesticides has steadily declined, as indicated by a drop in production of calcium arsenate from a peak of 84,136,000 pounds in 1942 to only 16,000,000 in 1949, and a decrease in lead arsenate from a high of 90,705,000 pounds in 1944 to 17,000,000 pounds in 1949. However, the first half of 1950 saw an increase in manufacture of these compounds, because of high insect infestations and shortages of benzene and chlorine for production of organic compounds. U. S. output of white arsenic dropped from 72,198,000 pounds in 1944 to 25,590,000 pounds in 1949. Imports declined from 32,700,000 pounds in 1942 to 9,393,000 pounds in 1949, but rose to 10,770,000 pounds in the first half of 1950. Output of copper sulfate has not shown a steep decline, principally because of heavy export demand for control of sigatoka disease in the banana-producing countries of Central America; however, 1949 production of 158,000,000 pounds was 38 percent below the high of 255,600,000 pounds in 1946.

U. S. exports of all pest control chemicals rose from slightly less than $5,000,000 in 1949 to over $28,000,000 in 1949. Exports of calcium arsenate and lead arsenate increased little during the decade but shipments of copper sulfate showed a considerable rise. However, the large increase was in classifications consisting principally of organic products, which rose over $20,000,000 in the 10-year period, and continued at an accelerated rate in the first half of 1950. In all three periods North America was the largest market, with the Central American countries taking the major portion of inorganic materials. Exports of organic pesticides to North American countries in 1949 were eight times those in 1939, and in the first half of 1950 shipments to this area exceeded those for the entire year 1949, with Canada and Mexico as the major markets. South America was consistently in second place, largely because Brazil ranks as an important market for United States pesticides. However, judging from exports in January-June 1950, shipments to individual areas — other than North America and the Caribbean islands — will be lower than in 1949. Exports of inorganic materials to the Eastern Hemisphere dropped to almost nil in the first 6 months of 1950.

Canada—According to official statistics, in 1949, out of total sales of pest control chemicals in Canada—$14,202,000, 38 percent consisted of organic products, compared with 18 percent in 1947. In 1937, production was $1,180,000, practically all of which was inorganic materials.

Only three organic pest control products are made in Canada—DDT, 2,4-D, and parathion. Although DDT sales increased little between 1947 and 1949, sales of 2,4-D rose spectacularly—from $554,000 to $3,458,000. According to the United States Embassy at Ottawa, use of organic insecticides will increase still more, but not to the extent which occurred betweent 1947 and 1949. However, it is believed that 2,4-D consumption will rise considerably. Government use of organic pesticides in such programs as the current control of blackfly in several provinces also will tend to increase consumption. Despite some production of organic commodities in Canada and importation of BHC from the United Kingdom, United States exports of organic pesticides to Canada rose from $604,000 in 1939 to $4,017,000 in 1949, and in the first half of 1950 were 97 percent of shipments for the entire year 1949. In the same period United States exports of inorganic pesticides to Canada dropped from $127,000 to $4,000.

Mexico—A report from Mexico states: "The rise in consumption of new organic pesticides has been phenomenal with a 50-fold increase in the past 5 years." Estimated annual demand for technical DDT is 2,000 metric tons; consumption of BHC is 2,500 tons annually, with a potential of at least 3,500 tons; and about 50 tons of other new organic pesticides are consumed each year. In 1944, 80 percent of Mexican imports of pest control materials consisted of inorganic materials, but in 1949 the position was reversed and 80 percent was organic products. United States exports of organic pesticides to Mexico rose from $121,000 in 1939 to $1,875,000 in 1949, and were $2,450,000 in January-June 1950. Although output of calcium arsenate has been inaugurated

in recent years, the above data indicate a decided trend toward use of the new pesticides, particularly for protection of the important cotton crop.

Central America—This area is not a producer of pest control chemicals, although some mixing of imported toxic ingredients is carried on. The United States is the principal supplier, with copper sulfate the major commodity used. However, consumption of organic materials increased in the past decade.

In 1939, 88 percent of United States exports to Costa Rica consisted of inorganic materials and by 1949 this percentage had changed little. In Guatemala the percentage of inorganics dropped from 92 in 1939 to 84 in 1949. United States exports of organic commodities to Honduras in 1949 were three times those ten years previous. Nicaragua is not a large consumer of insecticides but in 1949 organic commodities constituted 90 percent of United States exports to that country. Panama is an outstanding exception in this area—with 60 percent of United States exports consisting of inorganics in 1939 and 90 percent in 1949, largely because of increased use of copper sulfate on banana plantations; however, 1949 exports of organics were actually four times those in 1939. El Salvador shows the greatest increase as a market for organic pest control chemicals—from $11,000 in 1939 to $224,000 in 1949, and $196,000 in the first half of 1950.

Caribbean Area

NO real insecticide industry exists in this area. Cuba is the only large consumer, with practically all supplies obtained from the United States. With the exception of the British colonies, imports into the other islands also originate in the United States.

The British West Indies are not large consumers of pest control chemicals and exchange difficulties cause most supplies to be obtained from the United Kingdom. United States exports to these islands declined from $132,000 in 1939 to

United States Exports of Pest Control Chemicals, by Classification, and by Areas, 1939 and 1949-50[1]
(Thousands of dollars)

Area and principal countries of destination	Inorganic materials[2] 1939	1949	1950[1]	Classifications consisting principally of organic materials[3] 1939	1949	1950[1]
North America:						
British Honduras	(1)	—	—	3	1	9
Canada	127	50	4	604	4,017	3,900
Canal Zone	(1)	(1)	—	12	91	33
Costa Rica	99	642	347	13	94	61
Guatemala	291	703	484	24	131	98
Honduras	350	1,032	324	20	61	70
Mexico	139	375	250	121	1,875	2,450
Newfoundland	(1)	—	—	4	50	—
Nicaragua	(1)	8	1	2	75	91
Panama, Republic of	19	543	126	14	59	28
El-Salvador	3	2	28	11	224	196
Total	1,027	3,356	1,564	827	6,679	6,937
Caribbean area:						
British West Indies	73	2	2	59	64	19
Cuba	13	89	13	118	523	357
Dominican Republic	1	67	48	10	55	36
Haiti	14	39	15	5	17	8
Netherlands Antilles	(1)	—	—	15	60	34
Other	—	—	—	1	(1)	—
Total	101	196	77	210	719	454
South America:						
Argentina	73	(1)	(1)	258	149	35
Bolivia	13	5	(1)	2	12	31
Brazil	76	94	57	93	2,548	1,108
Chile	23	3	—	21	61	14
Colombia	27	480	213	105	750	387
Ecuador	2	3	2	13	102	56
Paraguay	—	(1)	(1)	6	87	4
Peru	214	61	9	51	576	195
Uruguay	1	10	10	16	130	37
Venezuela	3	24	1	171	786	504
Other	(1)	1	3	5	27	20
Total	433	681	296	741	5,229	2,392
Europe:						
Belgium	—	71	—	5	437	123
Denmark	—	—	—	1	140	150
Finland	(1)	—	—	55	5	8
France	1	—	—	41	91	49
Greece	—	1	(1)	35	1,140	260
Italy	—	—	—	38	1,446	1,110
Netherlands	—	—	—	22	395	89
Norway	1	—	—	20	141	60
Spain	—	26	—	4	1	1
Sweden	—	(1)	—	116	140	83
Switzerland	4	—	—	3	125	124
Turkey	5	—	—	69	716	49
United Kingdom	5	—	—	206	73	56
Other	(1)	—	—	21	(3)313	77
Total	17	97	(1)	636	5,164	2,239

(*Table Continued on Next Page*)

Asia and Oceania:						
Australia	4	——	——	120	157	42
British Malaya	——	——	——	20	18	3
Ceylon	——	——	——	5	447	25
China	——	——	——	10	15	93
Hong Kong	①	——	——	20	82	32
India	——	——	——	98	201	46
Indonesia	5	——	——	52	615	382
Iran	——	10	——	①	131	212
Japan	——	3	①	126	821	249
Korea	③	103	——	③	282	——
New Zealand	7	——	——	38	316	40
Palestine	1	——	——	22	199	61
Philippine Republic	7	17	5	55	381	184
Saudi Arabia	——	——	——	1	130	44
Thailand	——	——	——	6	147	42
Other	①	1	2	25	117	86
Total	24	133	7	598	4,058	1,541
Africa:						
Algeria	——	364	——	2	95	49
Belgian Congo	——	1	——	1	100	89
Egypt	2	3	1	14	337	103
Liberia	——	——	——	1	23	12
Morocco	——	——	——	3	74	71
Mozambique	①	——	——	78	163	140
Union of South Africa	13	——	——	212	738	157
Other	——	——	——	33	81	54
Total	16	367	1	344	1,610	674
Grand total	1,618	4,830	1,945	3,356	23,459	14,237

[1] January-June.

[2] Calcium arsenate, lead arsenate, and copper sulfate.

[3] Includes pyrethrum extract, paradichlorobenzene, nicotine sulfate, and Schedule B basket classification "Other agricultural insecticides, fungicides, and related materials, "Household and industrial insecticides," and "Household and industrial disinfectants." Such inorganics as wettable sulfur, sodium arsenate, bordeaux mixture, thallium sulfate, etc. are included, but a large percentage of exports in these basket classifications consist of organic materials.

① Less than $500.

② Principally DDT to Bulgaria, Rumania, and Yugoslavia.

③ Not separately classified in 1939; included with Japan.

Source: 1939, Foreign Commerce and Navigation of the United States; 1949-50, Bureau of the Census, U. S. Department of Commerce.

$66,000 in 1949; however, organic materials showed a slight increase, whereas shipments of inorganics dropped from $73,000 in 1939 to almost nil in 1949. According to United States export statistics, $613,-000 worth of pesticides were shipped to Cuba in 1949, contrasted with $132,000 in 1939, with the rate in the first half of 1950—$370,000—still higher. Percentagewise, inorganics kept pace with organics until the first half of 1950 when 96 percent consisted of organic materials. Use of DDT, benzene hexachloride, and 2,4-D is on the rise, with DDT being consumed in the greatest amount. United States exports to the Dominican Republic rose from $11,000 in 1939 to $122,000 in 1949 when over half consisted of inorganic materials. This situation is due to large shipments of copper sulfate; however, exports of organic materials increased five-fold in the 10-year period. Imports into Haiti, practically all from the United States, consist mostly of copper sulfate, and the percentage of inorganics and organics differed little in the two years. In recent years the United States has been the principal supplier of pesticides to the Netherlands Antilles, with exports in 1949—entirely organic commodities—totaling $59,500, compared with $15,520 in 1939.

South America

SOUTH America is a large consumer of pesticides, and since World War II a definite trend toward organics has been evident. With the exception of calcium arsenate in Peru and rather minor quantities of copper sulfate in a few countries, production of inorganic pesticides is insignificant; however, several of the more highly industrialized republics have inaugurated manufacture of benzene hexachloride and DDT. The United States is the source for the major portion of imports; in fact, South America is the second largest export market for United States pest control chemicals. In 1949 exports of organic pesticides to that continent—$5,229,000—were seven times those in 1939, while shipments of inorganic insecticides rose only about 50 percent in the same period, with the increase in exports of copper sulfate to Colombia accounting for the difference.

Argentina—In 1946, Argentina consumed around 7,000,000 pounds of inorganic insecticides for agricultural purposes. In that year 22,000 pounds of DDT dust were used; by 1949 this figure had risen to 1,500,000 pounds. A plant recently put in operation was to have a capacity of 1,750,000 pounds of DDT a year. Imports of DDT in 1948 were 1,500,000 pounds, against 1,200,000 in 1947. Over 2,000,000 pounds of BHC are manufactured annually and consumed largely for control of locusts; however, it is expected this commodity will be used increasingly in cattle dips. In 1946, 38,000,000 gallons of arsenical type,

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Louisiana Insect Control Conference

THE 1951 Louisiana Insect Control Conference was held at the Bentley Hotel, Alexandria, Louisiana, January 9 & 10. More than 100 representatives of the insecticide industry attended. Rudolph G. Strong, Louisiana Agricultural Extension Service assistant entomologist, served as general chairman of the conference.

In the opening talk: Mr. Strong stressed that with research, Agricultural Extension, and industry representatives working in a unified and cooperative effort, the type of insect control program needed in Louisiana could be obtained. He pointed out for example that through cooperative insect control measures in 1950, Louisiana cotton farmers had produced over $78,000,000 more cotton than would have been produced otherwise.

Horace Lee, Niagara Chemical Division of Food Machinery Corporation, served as chairman of a panel on "The Insecticide Supply Situation." Other members of the panel included W. C. Edgar, Hercules Powder Company; J. F. White, Julius Hyman & Company; H. Boyd, Commercial Chemical Company; Harold Noble, S. B. Penick & Co.; A. E. Grazer, California Spray Chemical Company; and Irwin F. Schroeder, Pennsylvania Salt Manufacturing Company.

Members of the panel stated that shortages of chlorinated hydrocarbons were evident at the present time and might later become even more acute, especially materials used for cotton insect control. Increased prices of these materials were discussed. Boyd said that calcium arsenate was in short supply and prices had increased. Harold Noble reported that Ryania, used in Louisiana especially for the control of the sugarcane borer, was sufficient for the demand and that prices had not increased. Cryolite, another material used in large amounts for the control of the sugarcane borer, was said to be short and prices higher. Sulfur was reported to be in short supply at most plants.

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Below, top picture (L to R): Front seated: J. F. White, Julius Hyman and Company; W. C. Edgar, Hercules Powder Company; Horace W. Lee, Niagara Chemical Division; Hallam Boyd, Commercial Chemical Company; J. L. Crigler, Tobacco By-Products and Chemical Corporation. Standing: J. Everett Bussart, Velsicol Corporation and I. J. Becnel, Freeport Sulphur Company.

Lower picture (L to R): William D. Beck, E. I. du Pont de Nemours & Co., Lewis P. Harris, Cotton States Chemical Company; Hal C. Dilworth, National Cotton Council of America; J. A. McDaniel, Louisiana Agricultural Extension Service and L. H. Bailey, Thompson-Hayward Chemical Co.

Top photo (L to R): Roy C. Meek, Niagara Chemical Division, Rudolph G. Strong, Louisiana Agricultural Extension Service, assistant entomologist, and Harold Noble, S. B. Penick and Company.

Second photo (L to R): Dr. B. Thomas Snipes, U. S. Industrial Chemicals, Inc., Director H. C. Sanders, Louisiana Agricultural Extension Service, and Charles E. Roemer, II, Scopena Plantation, Bossier City, La.

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The Listening Post

This department, which reviews current plant disease and insect control problems, is a regular monthly feature of AGRICULTURAL CHEMICALS. The comments on current plant disease problems are based on observations submitted by collaborators of the Plant Disease Survey Bureau of Plant Industry, Soils, and Agricultural Engineering, U. S. Department of Agriculture, Beltsville, Md.

By Paul R. Miller

PETER A. Ark, of the University of California, reports that the organic compound known as 8-quinolinol benzoate has been useful in controlling various fungus and bacterial diseases of orchids. During the last two years he has employed another organic compound, the sodium salt of *o*-hydroxydiphenyl, which merits investigation as a promising agent for the control of damping-off fungi and certain bacterial pathogens.

This compound has been known to the medical profession and sold under the trade name "Natriphene". It is used in treating mycotic skin diseases as well as for general hygienic purposes. The chemical is not stable and is denatured by light and strong alkali. *In vitro* tests indicate its high degree of toxicity against many fungi and bacteria.

To evaluate its effectiveness against damping-off caused by *Rhizoctonia solani*, tests were made on tomatoes, peppers, marigolds, snapdragons, and orchids. With the exception of the orchids, 100 seeds of test plants were sown in small flats of pasteurized soil, each test consisting of three series. In one series, *Rhizoctonia solani*, previously isolated from the corresponding plants, was established in flats of pasteurized soil by introducing the fungus mycelium two weeks before planting the seed. The second series was similar except that as soon as germination was observed the flats with the fungus were saturated with a 1 to 1000 solution of sodium salt of *o*-hydroxydiphenyl to one of the *Rhizoctonia*-infested soils. In a third series the plants were grown in pasteurized soil alone. Counts of diseased plants were made weekly for a month. A typical protocol of the results is shown in table 1.

A few nurserymen, growing annuals for sale as bedding plants, used this chemical as indicated above and obtained similar results. In the course of the investigation it was observed that occasionally slight burn was produced on very tender plants when a technical grade was used. The medicinal grade has not given any injurious effects.

This chemical was used successfully to control certain bacterial diseases of orchids. The method consisted in complete immersion of diseased plants in a 1:2000 solution of the chemical for 60 minutes or longer. There was no visible injury on treated plants.

Diseases of Orchids

PETER A. Ark and Mortimer P. Starr, of the University of California, state that three bacterial diseases of orchids sometimes cause considerable losses in central California, while a fourth bacterial disease, although extremely destructive, is of rare occurrence and so far has been observed only once.

Brown spot of *Phalaenopsis* and *Cattleya*, caused by *Phytomonas cattleyae*, is common in the greenhouses. Lately it has been especially severe in *Phalaenopsis* seedlings in community pots. Symptoms on small *Phalaenopsis* seedlings consist of one or more circular water-soaked spots of dark green color at first which change into dirty green through various shades of brown and finally black. The disease when unchecked, spreads rapidly, resulting in great numbers of dead seedlings. In one orchid house large old plants of *Phalaenopsis* were severely attacked and considerable losses were inflicted before the disease was stopped. On large plants of *Phalaenopsis* the disease can start at any place on the blade, finally reaching the growing point.

On *Cattleya* the disease does not seem to move as fast as in the *Phalaenopsis* and is limited to the older leaves. The lesions are more discrete and well delimited. Often the lesions are sunken and black. The mode of infection in *Cattleya* is the same as in the *Phalaenopsis*. The spots on *Cattleya* are checked by local application of corrosive sublimate, 1:1000, applied with a cotton swab. The treatment has to be repeated several times until the disease is stopped.

The disease can be prevented to a great extent by avoiding overhead irrigation and giving good aeration. The seedling phase of the disease in *Phalaenopsis* is controlled by drenching with one of the following chemicals: 8-quinolinol benzoate (or sulfate), 1:2000, or the sodium

Table 1.

Effect of Natriphene treatment on damping-off caused by Rhizoctonia. Number of plants at the end of 30 days.

Plant	Pasteurized soil	Rhizoctonia added to the soil	4 applications of Natriphene to soil containing Rhizoctonia
Tomato	90	20	75
Pepper	85	0	78
Marigold	100	5	95
Snapdragon	98	0	95

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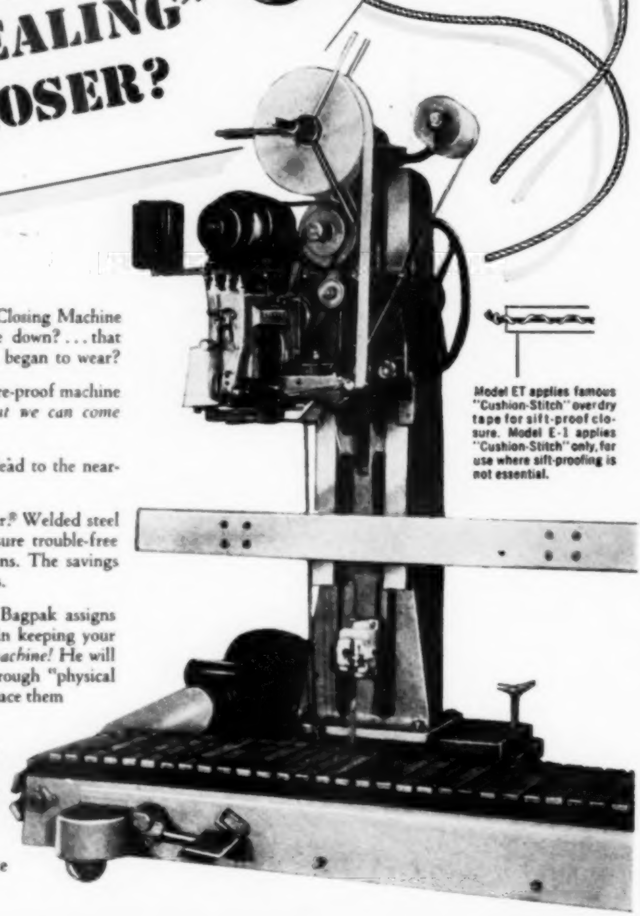

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salt of *o*-hydroxydiphenyl, 1:2000. If desired, the pots having a community of seedlings can be submerged in the solution and left an hour or longer. The treatment can be repeated. No injury has been observed on experimental plants so treated and many growers are using this method of control. The treatment can be repeated in about two weeks, if necessary. The chemicals mentioned above do not cause any residual effect since they are broken down by bacteria in the substratum. Large *Phalaenopsis* plants should be treated by submerging them in 8-quinolinol benzoate (or sulfate) or the sodium salt of *o*-hydroxydiphenyl ("Natriphene") for several hours. By this method seriously infected plants 30 years of age and older were completely cured.

Brown rot of *Cypripedium* was found to be very serious in several houses. The disease starts as a small circular or oval water-soaked and somewhat greasy light brown spot. Several spots may occur on one leaf. The lesion becomes somewhat sunken, dark brown and later deep chestnut in color, and the margin is well defined. The infection works its way into the growing point at a very rapid pace if the temperature in the house is above 65° F. and the humidity is in the neighborhood of 70 percent or higher. The disease is controlled by the same methods described above.

A disease of *Miltonia* characterized by leaf scorch and pseudobulb rot has been found to be caused by bacteria, not yet determined. The disease produces tip blight or scorch which may be arrested and then appear toward the base of the leaf in the form of a water-soaked streak leading into the growing point on the pseudobulb. The infected pseudobulb tissue first becomes straw yellow and later orange red or bright red. Rotting of the pseudobulb is accomplished by other organisms which sometimes follow the primary pathogen. The pathogen progresses through the rhizome of the plant and can attack new pseudobulbs from below the crown. Attacked leaves frequently drop and only the orange-red pseudobulb may remain in the pot. The infection starts from wounds, which may be numerous on the brittle leaves of *Miltonia*. The disease spreads from plant to plant if segregation and chemical treatment are not followed. 8-quinolinol benzoate and "Natriphene" gave the best results in checking the disease.

One case of soft rot of *Cattleya* orchids caused by the common bacterial soft rot organism, *Erwinia carotovora*, has been found in California.

Black Spot, Vanda Orchids

RECENTLY flower spoilage has been observed on blooms of *Vanda tricolor* shipped from Hawaii to San Francisco for re-distribution to various parts of the country, according to Peter A. Ark and William C. Snyder of the University of California. Flowers received on both the Chicago and San Francisco markets have shown petal discoloration and black spots of varying sizes in the flower throat below the labellum, rendering the blossoms unsalable. Under conditions of high humidity the blackened areas enlarge.

Control of the black spot has been effected by spraying the blossoms with a solution of "Bioquin 700" (*o*-quinolinol benzoate) before the appearance of symptoms. No injury has been observed on sprayed flowers shipped by air from San Fran-

(*Turn to Page* 87)

Observations on some Major Insect Pests

This column, reviewing current insect control programs, is a regular feature of AGRICULTURAL CHEMICALS. Dr. Haeussler is in charge of Insect Pest Survey and Information, Agric. Research Adm., B. E. & P. Q., U.S.D.A. His observations are based on latest reports from collaborators in the department's country-wide pest surveys.

By G. J. Haeussler

WITH winter about half over and the crop season for 1951 soon about to begin, there is the usual speculation as to what the year is likely to bring forth in the way of infestations of the more important insect pests of crops and livestock. It's still too early, however, to determine how and in what numbers various pests are surviving the winter. Reports now being received chiefly summarize the status of insect conditions during the past year and point out the materials and methods that gave most satisfactory control. So, until more definite information becomes available regarding the current status of pests, this would seem to be a good time to review a few of those reports.

Greenbugs Again Threaten

STATE and Federal agencies are keeping a careful watch on the development of greenbugs and other pests of wheat that usually reach damaging proportions early in the season. Last year about 3 million acres of small grains were infested by this pest in Oklahoma, the outbreak extending into large acreages of Texas and southern Kansas. More than 650,000 acres of wheat in Oklahoma were treated with parathion applied from aircraft and ground equipment resulting in an increased return to the farmer estimated at almost $4,000,000.

During the winter greenbugs are found chiefly near the crown of the plants. Reports from Oklahoma indicate their presence in sufficient numbers to cause trouble if weather conditions during the remainder of the winter and later activities of natural enemies do not adequately check development. In Texas and the southern half of Oklahoma, greenbugs may become destructive as early as late February, while in other areas damage usually develops later in the spring. In general, if damage in the

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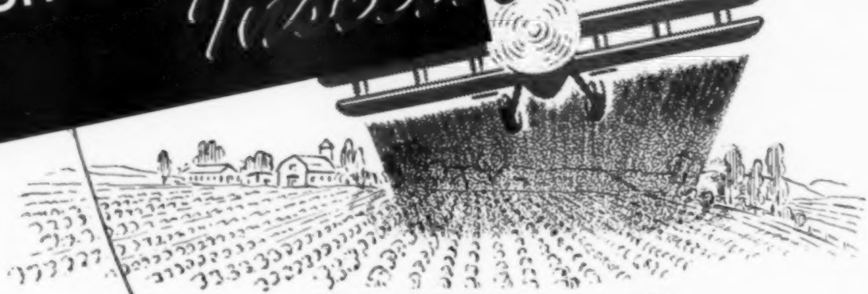

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south-central States does not show up until early April, natural enemies usually bring the greenbug under control and make spray treatments unnecessary.

The widespread use of parathion, applied either as a spray or as a dust, gave very satisfactory results in combating the 1950 greenbug outbreak. Recommendations for the use of parathion and tetraethyl pyrophosphate in greenbug control in 1951 are contained in a publication entitled, "Recognition and Control of Greenbugs and Other Early-Appearing Pests of Wheat," issued by the Oklahoma Agricultural Experiment Station in cooperation with the U. S. Bureau of Entomology and Plant Quarantine. This publication also states that parathion as recommended for use against greenbugs will give partial control of the crown aphid, a species that has been reported currently more abundant than usual in western Oklahoma, western Kansas, and the Texas Panhandle.

Corn Borer in New Areas

A SPECIAL supplement to the insect pest survey, entitled "Status of the European Corn Borer in 1950," was to be issued early in February by the Bureau of Entomology and Plant Quarantine. Compiled and summarized by E. W. Beck, of the Division of Cereal and Forage Insect Investigations, from field data obtained by State Agricultural Agencies, this report discusses the distribution and abundance of the insect last year. Limited scouting in September disclosed the presence of the borer in 7 States from which it had not been reported previously. It was found in 2 counties in Alabama, 4 in Arkansas, 2 in Colorado, 2 in Georgia, 3 in Mississippi, 3 in Oklahoma, and 1 in South Carolina. Searches made in 1949 and again in 1950 in the vicinity of an infestation reported in 1948 in the Parish of St. John the Baptist, Louisiana, failed to disclose any evidence of the European corn borer. This suggests that either the insect failed to survive in that locality or the infestation is so low that it could not be detected by the type of scouting conducted. Some spread of the borer was reported in 1950 within 9 States previously known to be infested. This pest is now known to occur in 36 States. There appeared to be little change from 1949 to 1950 in the low level of abundance of the borer in the eastern states, but a general decrease in abundance was evident in the north central states.

Recommendations for insecticidal control of the European corn borer in the north central states, as approved by the Regional Technical Committee were issued in December, 1950, by Iowa State College as Pamphlet 164. This regional publication gives detailed recommendations for the treatment of field corn, canning corn, and market sweet corn. DDT and Ryania are still recommended as the materials which have given most satisfactory results for European corn borer control.

Japanese Beetle Spreads

A REPORT submitted by the Federal Japanese beetle laboratory at Moorestown, N. J., indicates that the area over which this insect is generally distributed was greater in 1950 by some 5,140 square miles than in 1949. The beetle is now estimated to be generally distributed over 53,050 square miles in eastern United States. The greatest spread occurred to the south and west in Virginia, and to new territory in northeastern Pennsylvania. Beetle populations in 1950 were generally low in New England, southeastern New York including Long Island, New Jersey, Delaware, and eastern Maryland. Evidence of beetle feeding was noticeably lighter than for many years in parts of that area. The reduction in beetle numbers was due, at least to some extent, to the fact that in the summer of 1949, rainfall was below normal over much of that area, a condition unfavorable to development of the brood which produces beetles in the following year. Beetles were present in abundant numbers in 1950 in eastern West Virginia, western Maryland, and northern Virginia, where rainfall during the previous two summers had been normal or above. There are indications that some areas which experienced low beetle populations last year may expect to see slight increases in 1951. Rainfall in the summer of 1950 approached the normal amount in much of the infested area and the grubs of the Japanese beetle entered hibernation last fall in nearly normal condition.

Screwworms in Southeast

ACCORDING to a report by W. G. Bruce, A. L. Smith, and C. C. Skipper, of the Bureau of Entomology and Plant Quarantine, screwworm infestations were found in 1950 over a larger area of the Southeast than in any previous year. The northern boundary of the infested area extended roughly from southeastern Virginia southwest through central Tennessee and northern Mississippi. Light scattered infestations were found in Kentucky and western Tennessee. Infestations were especially heavy in Florida, Georgia, Alabama, South Carolina, and southwestern Mississippi. However, losses of domestic livestock as a result of screwworm attack were less severe than in 1949. Reduction of losses is largely attributed to the warnings of an impending serious outbreak issued early last spring, the successful educational programs by the Agricultural Extension Services which resulted in the application by stockmen of effective screwworm prevention and control programs, and availability in all infested areas of adequate supplies of screwworm remedies, especially "Smear 62." Although high screwworm populations persisted in the Southeast until late November, a severe cold wave at that time and prolonged cold weather since has apparently eliminated screwworms from all southeastern States except Florida. The exact situation will, however have to be determined by further surveys.★★

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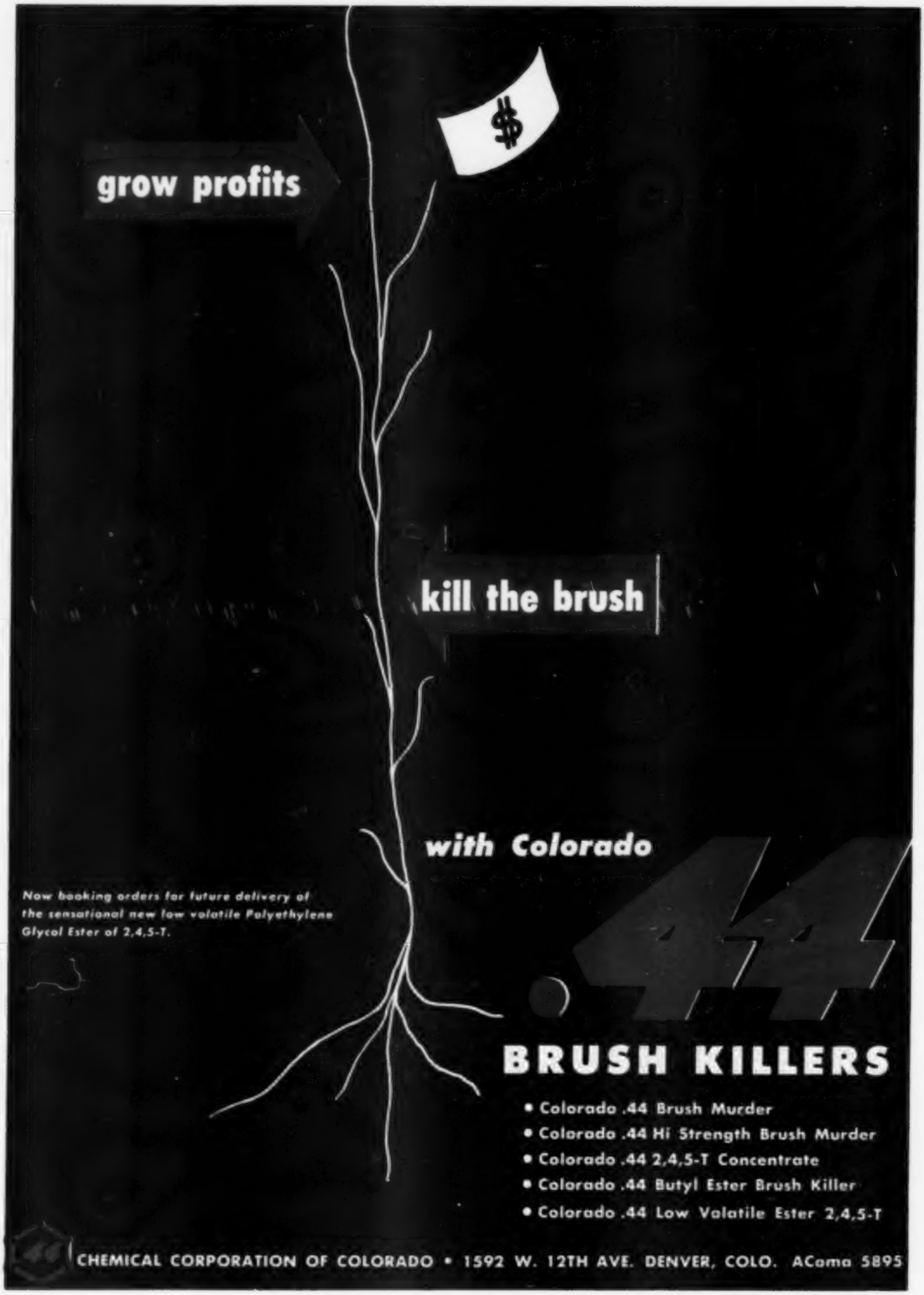
Hyman Appoints Haag

Garfield G. Haag has been appointed plant traffic manager of the Julius Hyman Co., Denver, Colorado. Mr. Haag was formerly associated with Witco Chemical Co.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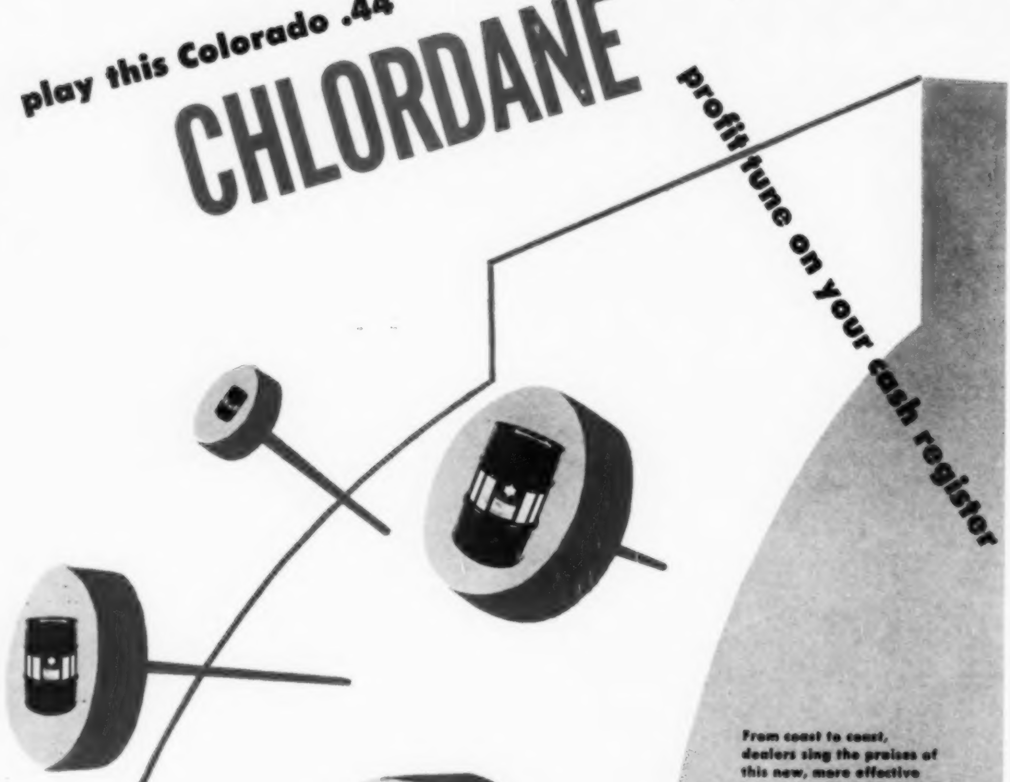
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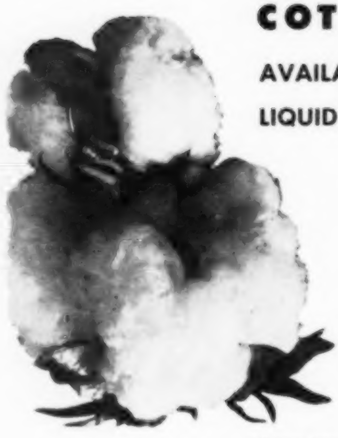

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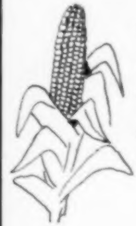

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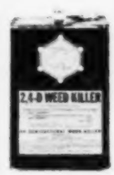

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Suppliers' Bulletins

Bemis Multiwall Booklet

Bemis Bro. Bag Co., St. Louis, has issued a 20 page booklet entitled "Multiwall Packaging Guide", which describes and illustrates ways to use multiwall bags more effectively and economically. The booklet deals with the storage of empty bags, filling, closing and handling of bags and palletizing and other related topics. Copies of the booklet may be obtained by writing to the company at 408 Pine Street, St. Louis, 2, Mo.

Baker Announces Booklet

The Baker Industrial Truck Division of Baker-Raulang Co., Cleveland, has announced a new eight page booklet describing the design and construction features of its Series B fork trucks in 3000 and 4000 pounds capacity. The booklet illustrates various features of the truck and photographs of its uses. The bulletin is available from the company, 1250 West 80th Street, Cleveland 2, Ohio.

Pa. Lists Publications

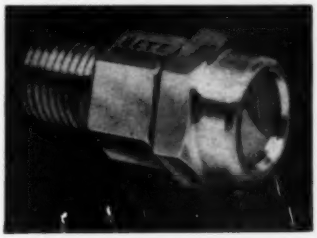
Pennsylvania State Agricultural Experiment Station, State College, Pa., lists the following progress reports which were released during the fiscal year ending July 1, 1950: No. 20,—Pest Control Materials, 1950; No. 26—Insecticides for Pennsylvania Tobacco; No. 29—Newer Pesticides, Formulations, Hazards, Precautions, and Compatibility; No. 33—Mushroom Insect Charts; No. 34—Applying Chemicals for Weed Control While Cultivating.

Filter Booklet Available

Pulverizing Machinery Co., Summit, N. J. has issued a booklet on its product, "Mikro-Collector", a machine used for collecting dust in the air. Making use of a felt bag as a filter, the machine will clarify the air and collect valuable dust, the makers state. The booklet describes ways of calculating filter rates, size, etc. and illustrates the way in which a typical machine works. Copies are available from the company.

Fan Nozzle Introduced

Bete Fog Nozzle, Inc., Greenfield, Mass., has announced a new line of flat spray or fan nozzles, as



illustrated above. Claiming more uniform coverage with less waste spray, it was announced that side jets or "horns" containing coarse droplets have been eliminated and the spray pattern made heavier in the center than at the sides.

According to the manufacturer, there is less overspraying due to the doubling up of the sprays from adjacent nozzles with the result that combined coverage is said to be unusually uniform.

Offers Analysis Booklet

R.C. Crippen, Baltimore, Md., has published a new bulletin listing prices on tests and analyses of insecticides, fertilizers, fungicides and herbicides. The folder, designated as Bulletin No. 3", gives complete data on such tests. Write R. C. Crippen Research & Development Laboratories, Fleet Street and Central Ave., Baltimore, 2, Md.

Safety Device Announced

Standard Safety Equipment Co., Chicago, has announced a new "Seal Tite" sleeve for workers engaged in handling toxic dusts and liquids. The protective measure consists of an adjustable tapering insert for use under gauntlet-type rubber gloves together with a tapering rubber sleeve hermetically sealed to fabric garments.

When the glove is inserted into the sleeve and pulled slightly away, a rubber to rubber contact is made which, it is claimed, seals the worker's arms and hands. Detailed information may be obtained from the company, 232 West Ontario Street, Chicago, 2.

NFA Award Bulletin Out

The National Fertilizer Association, Washington, D. C., has issued a public service bulletin to explain how the organization functions in its various fields, particularly that of informing the public and the trade, the story of fertilizer. Winner of two 1950 awards; the Award of Merit presented by the American Trade Association Executives and the Silver Anvil Award, presented by the American Public Relations Association, the NFA has issued the booklet mainly to present its prize winning material.

Dust Control Discussed

A 50-page book on dust control in chemical plants has been issued by the Pangborn Corp., Hagerstown, Md. The book presents a complete text on the subject, and is illustrated by both pen and ink drawings and photographs. W. O. Vedder is the author. Copies are available from the company.

Valve Bag Packer

E. D. Coddington Manufacturing Co., Milwaukee, has announced a new valve bag packer called the "Auger-matic" that will fill valve bags (25 to 100 pounds capacity) with any free flowing substance from powder to pellets. According to the company, the machine has push-button controls and is fully automatic including a weighting device with secondary adjustment wheel for fine weight adjustment.

It is claimed that one feature of the "Auger-matic" is the multiple auger which can be changed to fit

(*Turn to Page 89*)

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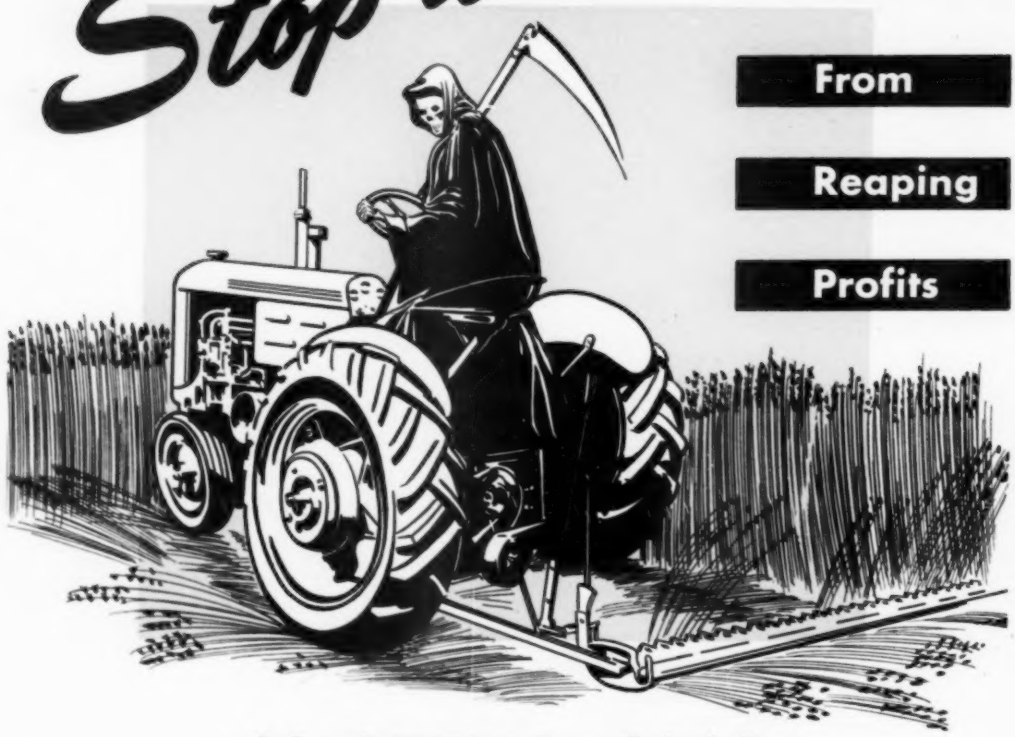

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Dealer and Distributor Inquiries Invited

Technical Briefs

No Radioactive Help

Maine Agricultural Experiment Station, Orono, Me., has issued an adverse report on a radio active commercial product, called "Alphatron," claimed by the manufacturer to stimulate plant growth and proposed for incorporation into potato fertilizers. In 36 paired comparisons of regular fertilizer mixture with fertilizer plus "Alphatron," there was no average difference in yield of potatoes at two locations, where the product was applied at the rate of 20 lbs. per acre, states the station report for the year ending June 30, 1950. "Alphatron" (dust) and "Alphatrol" (liquid) were also applied with spray and dust fungicides, but did not stimulate plant growth or result in increased yields. These results, says the report, agree with other experiments conducted with this material at other stations.

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Fly Resistance Studied

Albert S. Perry, University of California Entomologist, discussed the nature and causes of housefly resistance to DDT, at the recent Denver meeting of the American Association of Economic Entomologists. He told of studies made to determine what happens to DDT after it enters the bodies of flies of different susceptibility to this insecticide.

Exploratory tests showed that the ethylene derivative (DDE) was formed in large amounts within the DDT-resistant flies. Further tests indicated that there is a corresponding increase in the amount of DDE when approximate LD-50 dosages of the toxicant are applied to the various races of increasing resistance. Comparing the dead and living flies, it was clear that much less DDT remains in the bodies of living flies, i.e., survival is related to the ability of the individuals of each race to detoxify absorbed DDT.

He pointed out however, a puzzling fact is the large amounts of unchanged DDT still present in the bodies of living flies, especially of the highly resistant races. It should be mentioned, Dr. Perry said, that the highly susceptible race also converts DDT to DDE, but in much smaller quantity.

It was also found that when piperonyl cyclonene is added to DDT it has no appreciable effect on the susceptible race, but increases markedly the mortality of resistant races.

The mechanism of synergistic action has long been attributed to the increased pentration of the insecticide when the synergist was present. In the present case this is not the explanation, for about the same amount of DDT entered the body whether or not piperonyl cyclonene was added. The big difference lies in the conversion to DDE. It was shown that much less DDE is formed whenever piperonyl cyclonene was added. Thus, it appears that the action of this synergist with DDT is interference with the process of detoxification of the absorbed DDT.

Weed Research Committee Reports

Ed. Note: The final report of the Research Coordinating Committee of the Northeastern Weed Control Conference, which met in New York, January 3rd to 5th, was not available for the January issue. The following report divides each topic into two categories: 1. agreement and 2. problems needing more work. Dr. Robert D. Sweet, Cornell University, Ithaca, N. Y., Chairman of the Coordinating Committee, emphasized that these are not recommendations, but rather a guide for future research with herbicides.

At the final meeting of the NEWCC, recommendations were submitted by the Coordinating Committee for discussion and corrections. Disagreements were submitted from the floor and the tentative report corrected and rewritten to act as a guide in future research on various chemicals.

The field and sweet corn and forage crops discussion was conducted by T. E. Odland, Rhode Island State College, Kingston. The members were in general agreement on:

1. Pre-emergence application of $1\frac{1}{2}$ pounds of 2,4-D acid equivalent except in a sandy loam or lighter soil.
2. Post-emergence application of $\frac{1}{4}$ to $\frac{1}{2}$ pound of 2,4-D acid equivalent any time after emergence until field corn is 24 inches high, or sweet corn is 6 inches high.
3. Pre-emergence application of 300 to 600 pounds per acre of granular cyanamid is effective for weed control. Use of lighter rate for lighter soils is recommended.
4. Pre-emergence application of certain dinitros is effective for weed control when used at 3 to 6 pounds in 50 to 75 gallons per acre.
5. None of these are substitutes for cultivation—they are supplementary.
6. Chemical treatments will lessen the amount of cultivation necessary.
7. Specific recommendations must come from local experiment stations.

The group decided that problems needing more work included:

1. Effect of climatic and weather conditions on efficiency of chemical treatments.
2. Same for soil type effect.
3. Response of different hybrids to 2,4-D.
4. Effect of cultivation and chemical treatment combinations.
5. Influence of 2,4-D on nutritive value of corn.
6. Influence of 2,4-D on susceptibility of sweet corn to smuts and rootrots.
7. Use of sodium pentachlorophenate in corn at planting time.
8. Use of dinitros for post-emergence application.
9. Better means of measuring weed control.
10. Rate and placement with regard to size of corn.

The forage crops discussion brought general agreement from the group on the use of dinitros for controlling chickweed in alfalfa and the application of 2,4-D will help to produce a weed-free non-legume hay. It was felt that more study is necessary on pre-seeding treatment of seedbeds to control weeds during the seedling stage of the forage crop. There were also suggestions that the use of dinitros on specific weeds in

forage crops and spraying at seedling time be subject to further experimentation.

The small grains discussion was conducted by M. F. Trevett, University of Maine, Orono. The group was in general agreement on:

1. Spring cereals: use of 2,4-D at ¼ to ½ pound acid equivalent per acre after stooling but before jointing, except when grains are seeded to legumes.
2. Winter cereals (two stations reporting): spring application of ¼ to ½ pound of 2,4-D acid equivalent per acre before fully tillered, except when grains are seeded to legumes.

Problems needing more work included:

1. Fall treatments of fall-seeded grain.
2. Use of dinitros in selective formulations.
3. Use of 2,4-D in legume seedings at advanced stages of growth of nurse crop.
4. Control of wild garlic.
5. Use of MCP in legume seedings.

Weed control in vegetables was discussed under the direction of W. H. Lackman, Massachusetts Agricultural Experiment Station, Amherst. There was general agreement that selective herbicides were needed for spinach, cole crops, vine crops and lettuce.

Other vegetables discussed were asparagus, onions, carrots, beets, snap, lima, and field beans, and peas. General agreement was reached concerning asparagus in the following points:

1. 2,4-D at 1 pound per acre, before and/or after cutting season sometimes gives good control of broadleaves.
2. Granular (300-800) and defoliant grades (75-100) of cyanamid and cyanate ("KOCN") sprays can be used safely during the cutting season. The latter are applied as 1-2% sprays.

However, there are several problems concerning asparagus, on which members agreed more work is necessary. They are:

1. The lowest effective rates of granular cyanamid.
2. The place of "TCA", "DN's" and "PCP's" in asparagus weeding.
3. The use of Stoddard Solvent on seedlings.
4. Effective grass controls.
5. Time of application of cyanate.
6. New herbicides with greater residual effects.

The discussion on onions found the group in general agreement that "Cyanate" is the best selective herbicide to date, when all factors are considered, and that to date, cyanamid is the most effective and least dangerous pre-emergence herbicide for onions on muck soils.

However, it was decided that more work was needed on pre-emergence studies, the effect of environment on herbicidal activity and crop injury from cyanate, and a study on better grass and purslane killers.

In the discussion of carrots and the carrot family, the group agreed generally that use of Stoddard Solvent should be standard practice. However, celery and parsnips are more sensitive to Stoddard Solvent than other umbels. More work is needed on the problem of interrelation of chemical weeding—mechanical cultivation with crop yield and quality.

In discussing beets, it was noted that better selectives were needed and more study on preemergence was necessary, but it was generally agreed that 2 pounds of salt per gallon of water used after 4-5 true leaves will kill small broadleaves without undue crop injury.

There was no general agreement on the treatment of field, snap and lima beans. The group discussed the results of experiments showing pre-emergence treatment with DN's at 3-8 pounds and NaPCP at 20-30 pounds were promising, but were in general agreement that there is a definite requirement for work to show the effects of environment, possible variety susceptibilities, the lowest effective and the highest safe rates. There was also stated a need for new chemicals for selective use.

DN's and defoliant grade cyanamid as selective herbicides in peas were generally agreed upon to be effective. The group also agreed that pre-emergence studies with IPC, PCP, DN and Stoddard Solvent on spinach should be expanded. That more work was necessary with DN and Stoddard Solvent at the plant base of cole crops, was also brought out. It was stated that hill treatments and delayed planting treatments among vine crops and pre-emergence and/or pre-planting chemical treatments with lettuce need further investigation.

E. M. Rahn, Delaware Agricultural Experiment Station, Newark, Del., conducted the group discussing strawberries. They were in general agreement that 2,4-D up to ¾ pound acid equivalent per acre may be applied any time during spring or summer except when blossoms or fruit are present, during extended drought periods, and during the fall when fruit buds are differentiating. Not more than two applications should be made per season.

However, they felt that more work was necessary on:

1. Use of E. H. No. 1 (sodium 2,4 dichlorophenoxyethyl sulfate) as a seed toxicant for year-round weed control. Time and rate of application should be studied as well as its effect on plant growth and yields.
2. Use of IPC for the control of chickweed and annual blue grass. Time and rate of application and effects on plant growth and yields should be studied.
3. Timing of application of 2,4-D and its effect on flowering, fruiting, and runner production should be studied more thoroughly. Also varietal response should be studied further.
4. Preplanting treatments of 2,4-D at high rates, 4 to 6 pounds per acre, with previous dipping of plant roots in activated carbon should be tested in more locations.
5. Use of dinitros for the control of winter weeds, particularly chickweed, should be treated at more locations. Can a selective dinitro, such as Dow Selective, be used at low concentrations when strawberry plants are not fully dormant but when chickweed plants are very small and easily killed?
6. The value and economy of using geese in weed control should be studied.
7. New materials are needed.

Robert H. Beatty, American Chemical Paint Company, Ambler, Pa., led the discussion on woody plants. There was general agreement on the following four methods of treatment:

1. *Foliage application:* 2,4-D, 2,4,5-T or "Ammate" used in water. The solution is sprayed on the plant, covering leaves, stems and trunks to ground level. Applications should be made when the plants are in full leaf. For plants susceptible to 2,4,5-T (such as poison ivy and brambles) a concentration of 2 to 3 lbs. in 100 gals. of

(*Turn to Page 81*)

Washington News Letter

MANY significant developments have been noted on the Washington scene during the past 30 days or so. These doings are bound to have a considerable influence on the amounts of pesticidal chemicals to be available for the coming growing season. Restrictions and regulations with regard to supply of raw materials and technical chemicals will have their effect on the trade regardless of decisions reached in freezing prices or wages in the industry.

During the last week of January, the initial meetings of the insecticide advisory committees established by National Production Authority were held. On January 23rd, the Pesticide Industry Advisory Committee had its first meeting under the sponsorship of the National Production Authority. Its agenda consisted of discussions on the supplies of raw materials and the supplies of the chemicals using these raw materials in their manufacture. There were also discussions on the impact of defence orders on the pesticide industry and the effect of exports on domestic supplies, particularly those which are in short supply. Joseph Bates, director of the Chemicals Division of NPA, was Government presiding officer. The representatives from industry and their company affiliations are: Harry Langhorst, American Cyanamid Co.; Harold Davies, Calabama Chemical Co.; A. W. Mohr, California Spray Chemical Co.; Byron Webster, Chipman Chemical Co.; Tom McCormick, E. I. DuPont de Nemours & Co., Inc.; Mercer Rowe, Flag Sulfur & Chemical Co.; Paul Mayfield, Hercules Powder Co.; Julius Hyman, Julius Hyman & Co.; Jack Brunton, Kolker Chemical Works; James McConnon, McConnon & Co.; R. S. Roeller, Penn. Salt Mfg. Co.; Walter Bennett, Phelps Dodge Refining Corp.; John Stoddard, John Powell & Co.; Don Murphy, Rohm & Haas Co.; John Paul Jones, Stauffer Chemical Co.; G. F. Leonard, Tobacco By-Products & Chemical Corp.; John Rodda, U. S. Industrial Chemicals Inc.; Joe Regenstein, Velsicol Corp.; W. J. Lipfert, Woolfolk Chemical Co.; and Ernest Hart, Niagara Chemical Division, Food Machinery Corp.

The following day, January 24th, the first meeting of the DDT Industry Advisory Committee was held under the chairmanship of Louis N. Markwood of the chemicals division of NPA.

The committee discussed supplies of DDT, the impact of defense orders on the DDT industry, supplies of raw materials for the manufacture of DDT and the effect of exports on domestic supplies. The following were invited to participate in the DDT committee: Dr. Oskar Frey, Cincinnati Chemical Works; Tom McCormick, E. I. DuPont de Nemours & Co.; Jack Brunton, Kolker Chemical Works; H. C. Kohler, Monsanto Chemical Co.; Ernest Hart, Niagara Chemical Div.; Harold Davies, Calabama Chemical Co.; Mark Biddison, General Chemical Co.; Charles Gerlach, Michigan Chemical Corp.; Dr. Pincus Rothberg, Montrose Chemical Co.; and R. W. Roeller, Penn. Salt Mfg. Co.

It was considered likely that other industry advisory committees or task groups of the overall Pesticide Industry Advisory Committee will be formed to deal with other products including the arsenicals, 2,4-D and 2,4,5-T, and benzene hexachloride. It is quite likely, of course, that should other problems come up in connection with copper sulphate and other organic fungicides as well as fumigants and similar materials, that, industry groups may also be formed to consider these problems.

* * *

One of the most serious problems which has not received its full share of emphasis is the shortage of sulfur. Various agencies in Washington have been working on this problem but the conservation effort that could be brought about in the agricultural pesticide industry has not been stressed. The National Agricultural Chemicals Association has brought to the attention of its members the necessity for conserving the critical supply of sulfur and the Federal agencies have under way plans to publicize the necessity for conservation. However, it is recognized in the insecticide industry that often sulfur is used as a diluent or carrier, and elimination of this use during the shortage period could probably result in saving as much as 200 to 300 million pounds a year.

* * *

There will be issued shortly as an amendment to Order M-32, a section relating to DDT. As of press time, it was NPA's plan to require producers of technical DDT to accept not more or less than 25% of their production to fill DO orders. This quantity is required to fulfill heavy purchases of technical DDT and technical DDT-containing formulations which the armed forces require for their pest control program.

Whether this percentage will be increased or decreased once the minimum military requirements have been met, is not known. But depending upon the seriousness of the international situation, there are likely to be further changes in this picture.

Pesticides in the NPA are being handled by L. N. Markwood and Mrs. Laura Arrington of the Inorganics Section, Chemicals Division, NPA. Those in the Department of Agriculture concerned with the handling of pesticides are W. R. Alstetter, Deputy Director, Office of Materials & Facilities, and Dr. H. H. Shepherd in charge of pesticide requirements, as well as Mr. Laurence C. McAllister, Jr.

* * *

Manufacturers of agricultural chemicals are developing an understandable reluctance to advance the substantial sums which are required to finance research and development of new insecticides, fungicides, etc. They point out privately that, at least for the next few years, there promises to be an adequate market for scarce benzol, chlorine, etc., in the manufacture of products whose marketing is attended by less grief than has come to be expected in

the sale of many of the new agricultural chemicals. Can they be blamed, we wonder, for preferring to use their scarce raw materials to make products on which they need not face the threat of congressional investigations, damage suits, restrictive laws, et. al.?

* * *

And what is the grower to do if he faces either of two unattractive alternatives, — restricted supplies of pesticides, or unrealistic restrictions on pesticide use? With food processors, and the consuming public as well, demanding 100% clean food, containing no insect fragments, yet no insecticide residues and no off-odor either, he faces quite a set of problems. A set of problems, incidentally, which he would find impossible to solve without the aid of the pesticide industry.

* * *

Test flights will be made this season on a new plane especially designed for the aerial application of agricultural chemicals. Designed by Fred Weick, of Texas A & M, it is said to take off, cruise and land at exceptionally low speeds. It was designed with practicality and safety as paramount factors and should, with the necessary modifications that a season's test flying will suggest, be an admirable ship for the country's rapidly growing band of custom sprayers. It is reported that even with the aircraft industry focusing its attention on turning out military craft at top speed, arrangements will be made to set aside some capacity for this new aerial duster, since food production also is recognized as of paramount importance in the war preparation program.

* * *

The insecticide industry is watching with understandable interest to see whether or not the new Congress will reconstitute the Delaney Committee, as requested in the committee's interim report early last month. The report noted that various interested groups "should be given further opportunities to present their views and to comment on proposed legislation before any specific recommendations are made to Congress".

* * *

And if the committee is to continue its investigation, the industry is very much interested in whether it will continue under the direction of the same counsel whose conduct of the recent hearings was subject to such considerable criticism. The Washington grapevine holds that his appointment was more or less dictated by the Food and Drug Administration. Certainly the hearings, rather than being an unbiased search for facts, seemed designed to make out a case for the necessity of new legislation giving control over agricultural chemicals to FDA.

* * *

There is interest, too, in who will be appointed to fill the vacancy on the committee, if it is to resume its work. Some observers have commented that the new member should definitely be a man with farm background, as many of the present personnel of the committee represent urban districts and could not be expected to have first hand knowledge of the farmer's need for chemical aids if he is to harvest a maximum crop.

USDA Bulletins Listed

The U. S. Department of Agriculture has issued bulletin E-812 listing its E-Series publications 782-811, beginning in July, 1949 and continuing through December, 1950. Copies of the list are available from the U.S.D.A. Division of Insect Survey and Information, Washington 25, D. C.

World Fertilizer Use Up

New records in both production and consumption of fertilizer nitrogen were achieved during 1949-50, according to figures released by the British Sulphate of Ammonia Federation, Ltd. A 12 percent increase in world consumption of fertilizer nitrogens was noted, bringing the estimated total to about 3,790,000 metric tons. The percentage of increase in production was more however, and the cumulative stock carried forward at June 30, 1950, represents about 12 percent of the 1949-50 consumption, or six weeks of fertilizer nitrogen production.

World production and consumption of fixed nitrogen in thousands of meric tons, one metric ton equaling 0.9842 long ton, for 1949-50, as compared with the fertilizer year ending June-30, are reported as follows:—

	Production		Cons'mtion	
	1949-50	1948-49	1949-50	1948-49
Europe[1]	2,425.6	2,067.4	2,210.3	1,954.3
Belgium, Luxemburg	182.9	172.7	84.9	76.3
France	234.3	195.0	250.3	250.9
Germany — Western Zones	496.9	377.2	368.4	377.5
Netherlands	118.6	86.8	146.2	117.6
Norway	153.0	112.0	42.1	30.8
Italy	187.0	120.2	188.6	125.4
United Kingdom	361.8	356.0	276.4	248.9
Other Europe[1]	746.1	647.5	908.4	726.9
Asia[2]	470.5	372.1	738.9	636.8
China and Formosa	10.4	4.7	58.9	42.2
India and Pakistan	11.3	9.6	73.6	51.8
Ceylon	....	....	12.2	10.7
Japan proper	386.4	301.2	442.5	378.6
Other Asia[2]	62.4	56.6	151.7	153.5
Africa	18.6	17.4	149.2	123.4
Egypt	0.2	0.2	96.3	75.7
Other Africa	18.4	17.2	52.9	47.7
Oceania	11.9	12.6	22.8	18.4
America	1,791.5	1,686.8	1,296.0	1,248.1
U.S.A.[3]	1,328.0	1,214.0	1,176.1	1,141.5
Canada	190.0	189.8	43.4	39.1
Chile	270.9	280.8	14.0	12.2
Br. West Indies	....	....	7.3	8.8
Other American	2.6	2.2	55.2	47.0
World total	4,718.1	4,156.3	4,417.2	3,981.0

[1] Including Eastern Zone of Germany and U.S.S.R.
[2] Including North Korea and Manchuria, and
[3] Including Hawaii and Puerto Rico.

Cotton Labor Conference

A conference including government officials concerned with the migratory farm labor program and the Special Farm Labor Advisory Committee of the United States Employment Service met at the Willard Hotel, Washington D. C., during January. The meeting discussed the problem of legislation to meet a shortage in farm labor resulting from the 60 percent increase in cotton production scheduled for this year. The cotton goal is more than 16,000,000 bales as against 10,000,000 grown last year. Secretary of Labor Maurice Tobin, speaking before the conference, stated that the project would require more than 400,000 additional workers.

Totman to Ag. Committee

James C. Totman, elected to the Maine legislature last year, has been appointed to the state's agricultural committee, it has been reported. Mr. Totman is the son of J. E. Totman, Summers Fertilizer Co., Baltimore, Md., chairman of the board of National Fertilizer Association. The younger Mr. Totman is assistant treasurer of the Bangor, Maine, office of Summers Fertilizer Co.

INDUSTRY NEWS

Agronomists to Chicago

Fertilization and management of legume and pasture meadows was to be the theme of the annual meeting of Midwestern agronomists and the fertilizer industry scheduled to be held Friday, February 16, at the Palmer House, Chicago. The conference is under the sponsorship of the Middle West Soil Improvement Committee.

Soils research men from thirteen midwestern agricultural colleges were to appear on the program. Representatives of companies in the fertilizer, farm machinery, supply and equipment industries were to be in attendance.

Dr Garth Volk, head of the Agronomy Department of Ohio State University, was to act as chairman, with the program being conducted by the agronomists.

Reports on new research developments in pasture fertilization, seeding, legume-grass mixtures, and management of legume crops and pasture meadows were scheduled to be presented by six agronomists, representing all the states in the midwestern area.

Speakers were listed as including Dr. R. L. Cook, Michigan State College, representing Ohio and Michigan; Dr. G. O. Mott, Purdue University, representing Indiana and Illinois; Prof. E. N. Fergus, representing Kentucky and Missouri; Prof. Paul Burson, University of Minnesota, representing Minnesota and Iowa; Prof. Kling Anderson, Kansas State College, representing Kansas, South Dakota, North Dakota and Nebraska.

One of the features of the meeting was to be a report by Dr. D. R. Dodd, Ohio State University, on his survey of pasture practices and research in 27 states, with special emphasis on the corn belt. During the past summer and fall, Dr. Dodd has covered an area from the Canadian border to Kenutcky and from North Dakota to the Atlantic. He has also visited states in the South and Southeast to study winter grazing practices and management.

Weyl New NAC Editor

Val E. Weyl

Val E. Weyl, formerly of the USDA Bureau of Entomology and Plant Quarantine's Division of Grasshopper Control has been appointed director of information of the National Agricultural Chemicals Association, Washington, according to Lea S. Hitchner, executive secretary, of the Association. He fills the position vacated by Don Lerch who has established a Washington public relations firm specializing in agricultural services.

Mr. Weyl has had extensive experience in entomology and related work with both government and industry. He has conducted numerous surveys for the Bureau of Entomology and Plant Quarantine in Colorado, Montana and Texas.

As an industry entomologist, Mr. Weyl established and maintained a technical reference library, composed labels for pesticides, edited and prepared articles for company publications used by dealers and customers. In this capacity he also acted as a consultant to the advertising, merchandising and sales departments. Mr. Weyl is a native of South Dakota, was graduated with a B.S. degree cum laude from South Dakota State College where he also took graduate studies.

In addition, Mr. Weyl has completed a year of graduate research in fields of entomology and genetics at the University of Wisconsin.

As director of information for NAC, he will edit the NAC *News* and handle various other information projects.

New USI Plant in K. C.

Selection of Kansas City, Kansas, as the site for a second plant for the production of "Pyrenone Protectants", has been announced by U. S. Industrial Chemicals, Inc.

A four-story building, with a floor area of 40,000 square feet, has been leased for the manufacture of "Pyrenone Wheat Protectant", a specific insecticide for all types of wheat, and "Pyrenone Grain Protectant" for feed corn, rice, oats, barley and other grains.

The company revealed it had completed negotiations with Mueller & Co., Inc., of Kansas City, Kansas, an associate of Private Brands, Inc., to serve as manufacturing contractors and plant operators for USI.

The Kansas plant, which will have a monthly capacity of 2,500,000 pounds of protectants, provides a necessary supplement to production at USI's Baltimore plant, which will continue in operation. Location of the second plant in Kansas establishes a logical distribution center for supplying the material to the mid-west grain belt, and places it near the source of supply of some of the dilu-

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ents, or carriers, used in production of the products.

The Protectants, introduced in 1950, are formed by the impregnation of a carrier with "Pyrenone, which is a combination of piperonyl butoxide and pyrethrins. The powdered insecticides are mixed directly with the grains to attain control of and protection against insect infestation.

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Herrell to B.E.P.Q. Position

Appointment of Henry G. Herrell to the newly established position of deputy assistant chief for administrative affairs of the Bureau of Entomology and Plant Quarantine, has been announced by Avery S. Hoyt, chief of the Bureau. His appointment was effective January 12.

In his new position, Mr. Herrell assists in the direction of all Bureau administrative management functions and operations and participates in exercising policy direction and maintenance of organizational plans. Programs of personnel management, budget, fiscal, procurement, and property are included in his work.

Mr. Herrell came to the Department in 1927 at the age of 17 in the Bureau of Plant Industry, and has progressed through the various administrative grades. He is a native of Virginia and holds degrees from National University, and Ben Franklin University.

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Miller to A & S Board

Arkell and Smiths, Canajoharie, New York have announced that Carl A. Miller has been elected a director of the paper bag manufacturing company.

Mr. Miller is a graduate of New York University, and is presently senior vice president of the Irving Trust Company, New York. Mr. Miller saw service in both World Wars and joined the Irving Trust Company in 1920 as Assistant Commercial Engineer. In addition to being a director of Arkell and Smiths, he is a director in the Three States Realty Corporation and Hudson House, Inc. of New York City.

Penn Salt's New Alabama Plant Operating

Pennsylvania Salt Manufacturing Company's new plant for formulating insecticide concentrates and finished insecticide products at Montgomery, Alabama, has been completed and is now in production, the company has announced.

MEETINGS

National Canners' Association, Hotel Stevens, Chicago, Ill., Feb. 14-23.

Midwestern Chapter, National Shade Tree Conference, La Salle Hotel, Chicago, Ill., Feb. 14-16.

Kansas State Weed Conference, Topeka, February 15 & 16, 1951.

Short Course in Insect Control, Alabama Polytechnic Institute, Auburn, Ala., February 28 to March 2.

1st Annual Meeting, Southwestern Branch A.A.E.E., Adolphus Hotel, Dallas, Tex., Mar. 1 & 2.

American Mosquito Control Assn., Drake Hotel, Chicago, Mar. 6-8.

South Dakota State Weed Conference, Corn Palace, Mitchell, S. D., March 14 & 15.

N. Central Branch, A.A.E.E., Commodore Perry Hotel, Toledo, Ohio, March 21 & 22.

Short Course on Use of Aerial Equipment in Agriculture, Purdue University, Lafayette, Ind., March 30 & 31.

Nat'l Agricultural Chemicals Assn. Flamingo Hotel, Miami Beach, Fla. April 4, 5 & 6, 1951.

American Chemical Society, 119th Meeting, Hotel Statler, Boston, Mass., April 1-5; Hotels Statler and Cleveland, Cleveland, Ohio, April 8-12.

National Fertilizer Association, Greenbrier Hotel, White Sulphur Springs, W. Va., June 11-13.

Combined meetings of American Association of Economic Entomologists; Entomological Society of America; American Phytopathological Society; and the Potato Association, Netherland Plaza Hotel, Cincinnati, Ohio, December 9-13.

This plant, the company's first in the southeast, also includes a new district sales office of the agricultural chemicals department to serve southeastern agriculture. J. Drake Watson is district sales manager and R. O. White is plant superintendent.

Production equipment is designed to manufacture either concentrates of insecticide formulations for other blenders or finished insecticide products ready for growers' use. Products will include a complete line of recommended insecticides for use on cotton, peanuts, soybeans, potatoes and truck crops, and for livestock.

These will include various mixtures of DDT and 36 percent gamma isomer benzene hexachloride, both manufactured at the company's Natrona, Pa., plant, and toxaphene, sulfur, parathion and other active ingredients.

Made available to southeastern growers this season for the first time will be Pencal, Pennsalt's new neutral calcium arsenate. This product can be blended with organic insecticides such as BHC and parathion, for control of the boll weevil, bollworm, leafworm or aphid, thus allowing combination of those active ingredients in single applications.

In addition to manufacturing facilities, the new plant includes warehouse space for approximately 1,000 tons of finished material. Establishment of this is in line with the company's general policy of providing faster distribution service to meet requirements of southern agriculture.

Illinois Custom Operators School Held

Top (L to R) John H. Bigger, Ill. Natural History Survey; L. E. Dooley, custom spray operator, Burlington, Iowa; R. K. Ringel, spray unit manufacturer, Decatur, Ill.; Fred Dexheimer, custom spray operator, Ft. Atkinson, Wis.; and H. B. Petty, Ill. Natural History Survey and Agricultural Extension Service.

Below (L to R) Earl W. Davies, Gardner, Ill., president of ground sprayer assn.; Joseph Wright, aerial and ground spray operator, Portageville, Mo.; Robert Bankson, aerial operator, Blue Mound, Ill.; and Dr. W. P. Hayes head of dept. of entomology, U. of Ill. (Photos by Ill. Natural History Survey).

SOME 237 custom spray operators attended the third annual Custom Operators Training School held at the University of Illinois, Urbana, January 18-20. The ground operators association elected Earl Davies, Gardner, Ill., president; L. H. Presley, Washington, Ill., vice-president; and Robert Kirkpatrick, Princeton, Ill., secretary-treas. The aerial spray operators were to hold an election February 26, at Springfield, Ill.

The program was one of instruction on pests to be controlled and also on various insecticides and emulsions used for this purpose. Insect specimens were used by Dr. W. P. Hayes, U. of Ill., in his talk; Carl Weinman, U. of Ill., placed on the table bottles of chemicals which the operators mixed to see at first hand, poor emulsions compared with good stable ones.

Weed control was prominent in the study, with a session on weed identification, and another on winter brush control with various chemical substances. Defoliants were discussed by Dr. R. F. Fulleman, U. of Ill. and Dr. Julius Coon, U. of Chicago, briefed the operators on the toxic hazards of pesticide chemicals.

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Alabama Short Course

A short course in Insect Control is scheduled to be held at Alabama Polytechnic Institute, Auburn, with February 28–March 2 as the dates selected. The course, similar to the one held last year, will have in attendance crop dusters and sprayers, pesticide manufacturers, salesmen, growers and others interested in pest control. The larger portion of the attendance was expected to be from Alabama, but a considerable number will come from neighboring states of Georgia and Florida.

According to G. R. Williamson, manager of the Agricultural Sulphur & Chemical Co., Montgomery, Ala., major emphasis will be centered on control of insects affecting cotton production in the area.

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Asks 7 ppm DDT Tolerance

In a brief filed with the Federal Security Agency, Washington, D. C., Geigy Co., Inc., New York, has summarized its testimony which was presented before the recent Food and Drug Administration hearing. Conclusions reached following exhaustive study on DDT, were that the toxicant is required in the production of all fresh fruits and vegetables, and that there should be established a single, over-all quantitative tolerance of at least 7 parts per million for DDT residues on or in all fresh fruits and fresh vegetables. Drafting the brief for Geigy were John H. Pickering, Henry T. Rathburn, Merrill J. Bunnell and C. C. Alexander.

More Meeting Dates Wanted

Agricultural Chemicals hopes to expand its meeting calendar in future issues, to include more local and regional events such as state Horticultural Society meetings, gatherings of seedsmen, fertilizer and pesticide dealers, weed control groups and the like. Please send us information covering meeting dates and places, and names of officers of such groups. Address Agricultural Chemicals Editorial Department, 254 W. 31st St., New York City 1, N. Y.

So. Ag. Workers Meet

The 48th annual meeting of the Association of Southern Agricultural Workers was to be held in the Hotel Peabody, Memphis, Tenn., February 5-7; and the Southern Weed Conference was to be held the following two days at the Hotel Claridge, Memphis. Since the meeting was scheduled just too late for inclusion in this issue, a report will be carried in the March *Agricultural Chemicals.*

•

Bemis Names Div. S. Mgr.

T. H. Ashton, manager of the Bemis Bro. Bag Company plant at Omaha, Nebraska, announces the appointment of T. R. Mangelsdorf as sales manager of the Omaha sales division.

New Fertilizer Co. Formed

A new fertilizer retail company has been established in Charleston, Ill. by J. O. Eubank & Sons. Anhydrous ammonia will be furnished by Martin Seed & Supplies, also of Charleston.

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Cranberry Growers Meet

The annual meeting of the American Cranberry Growers Association was to be held January 27 at Pemberton, N. J. Among subjects to be discussed was that of fertilizer application to cranberries by airplane. Charles A. Doehlert, secretary-treasurer of the association, was to talk on this subject.

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Keefe Bill is Reintroduced

Reintroduction of the Keefe bill has been made in Congress by Usher L. Burdick of North Dakota. The bill, originally introduced in the 81st Congress, proposes to regulate the registration, manufacture, labeling and inspection of fertilizer and similar materials shipped in interstate commerce.

EDITORIAL

(*Continued from Page 29*)

erous to mention over the past two and a half years, there are still pesticide manufacturers who are trying to do business without having registered their products. Seems odd, but its true.

Should there be any of our readers among this minority, we hope this story will serve as one more strong reminder to get those products registered! And if there are others who may not be sure about their label and advertising claims, we urge such to look into the situation critically before someone else does!

FERTILIZER PRICES

(*Continued from Page 51*)

fertilizers, three materials, ammonia, ammonium sulfate and ammonium nitrate account for the bulk of that used in recent years to make general crop fertilizers for the country as a whole. For example, in 1947, these three furnished the following percentages of the total consumed in making all mixed fertilizers:

Type of materials	*% of total N*
Ammonia and solutions	50.8
Ammonium sulfate	28.0
Ammonium nitrate (solid forms only)	8.9
Natural organics	5.1
All other materials	7.2
Total	100.0

Delivered Costs

PUBLISHED wholesale prices are usually spot prices, F.O.B. producing points or C.I.F. ports. The fertilizer mixer, as a rule, actually pays more or less; which depends upon many factors, such as, whether he buys on contract, the quantities purchased, and the distance the fertilizer has to be shipped. It is believed that information on the actual cost of different forms delivered to the mixing plant would be of interest.

A study was made of delivered costs of solution and solid forms of nitrogen at typical fertilizer producing points throughout the country. A number of companies, both large and small, were asked to state exactly what the cost delivered to their plants had been per unit of nitrogen in ammoniating solutions, ammonium sulfate, and ammonium nitrate over a period of years. The replies are summarized in Table 3. Data from a locality where less than 3 companies operate are averaged with those from some other point in the same region in order to conceal individual returns.

Blank spaces in table 3 mean that the reporting company or companies did not have data for that year. In some cases the records had been destroyed and in others the material was not used by the reporting company in that year. In some localities, for instance Los Angeles, California, solutions were not used for making dry mixtures by any company until recently. A blank, therefore, many mean that the particular material was not employed in that area at the time of the survey, but not necessarily so.

Part II Next Issue

WEED COMMITTEE

(*Continued from Page 69*)

water is usually suggested. For plants susceptible to 2,4-D, such as willows and honeysuckle, a concentration of 1-2/3 to 2-1/2 lbs. per 100 gals. of water is usually suggested. On mixed stands of brush sensitive to the growth regulators, mixtures of 2,4-D and 2,4,5-T are generally used at concentrations of 3-1/2 to 4-1/2 lbs. per 100 gals. of water.

With regard to the form of 2,4-D and 2,4,5-T acid, the low volatility esters are usually employed; 2,4,5-T amine shows promise.

"Ammate" is less selective than the growth regulator type of herbicide and in most cases provides satisfactory control of mixed species of brush. It is usually applied at ¾ to 1 lbs. per gallon of water; the addition of a spreader-sticker is desirable to afford proper coverage.

2. *Stump treatment:* Research reports on stump treatment are confusing with regard to 2,4-D and 2,4,5-T. Stump treatment as described here refers to cut woody plants over 4" in diameter.

There is some agreement on the following chemicals and concentrations: for mixtures of 2,4-D and 2,4,5-T, use 6 to 22 lbs. acid equivalent in 100 gallons of Diesel oil or kerosene, keeping to the higher rates for the mixtures. Make application with a low volume sprayer, covering the sides of the stump to ground level with enough material to wet the sides thoroughly. It is still a debatable question whether one should use a low concentration and apply a large volume, or a high concentration and low volume.

Concentrated mixtures of equal parts 2,4-D and 2,4,5-T containing very high amounts of acid but applied as low volumes of the acid in water have been reported as very effective.

"Ammate" may be spread on the stump top as a dry powder, or the bark may be loosened with an axe and the Ammate placed in the crevice. Use about ⅛ lb. Ammate per 6" diameter of tree or make a concentrated solution of 4 lbs. Ammate per gallon of water and spray or paint cut surfaces.

3. *Frill method:* Frilling is accomplished by downward axe blows extending around the trunk and cutting into but not removing the wood. The method should be followed for large thick-barked trees which cannot be killed by basal treatment. Frill cuts should be close together around the tree because the horizontal movement of herbicides in trees is poor.

Good results have been reported from applying 4 to 8 lbs. of 2,4,5-T ester or amine in 100 gallons of water to frills or cups in standing trees.

"Ammate" is being used in

killing undesirable hardwoods in forests by the frill method. Apply the dry crystals or make a solution using 4 lbs. of Ammate per gal. of water and pour in frills, or spray or paint exposed surfaces with this concentration solution.

4. *Basal treatment:* This treatment employs the application of 2,4,5-T or mixtures of 2,4-D and 2,4,5-T in Diesel oil or kerosene to the bole or basal parts of plants without cutting the bark.

   The concentration range most effective on most of the woody plants is between 10 and 20 lbs. of the acid in 100 gals. of oil. The amount of material per acre will vary with the density of brush; it is still debatable whether high concentrations applied in low volumes are most effective or low concentrations applied in large volumes of carriers, with enough applied to run down and settle on the ground.

   Species differ in their reaction, red maple reacting to much lower concentrations than ash or sour gum. 2,4,5-T amine applied in water, using about 64 lbs. of 2,4,5-T in 100 gals. of water in low volumes, has been effective in killing blackjack oak from December to March in Oklahoma.

   The basal type treatment is effective at most seasons of the year; however, more work is needed in this area during November, December and January.

It was also requested that in all future reports concerning woody plants, the active ingredients should be referred to in terms of pounds of total acid equivalent per hundred gallons of diluent. This was in place of the old method of stating the active ingredients in percent of ppm.

The group concluded that problems needing more work were:

1. Development of a complete list of woody plants in the east and the chemical, concentration, time of year and method most successful for killing each, with particular emphasis on reactions in early fall or spring. Basal sprays should be applied to the more troublesome species at monthly intervals to find the time when those plants are most susceptible.
2. More work is needed on dormant spraying with respect to timing, chemical, concentration, volume and most effective carriers.
3. More information on species reaction to stump spraying with regards to the amount of material needed for a given size stump, and the most suitable nozzle.
4. Species producing many lateral root sprouts should be studied to determine the most effective method of killing these lateral root buds.
5. Work is needed on the most suitable formulation for eradicating brambles in Christmas tree plantings.
6. More work is needed on the use of amines of 2,4,5-T and 2,4-D in frill treatment.
7. More work is needed on the use of 2,4,5-T with various adjuvants, such as TCA, added to a water spray.
8. Investigation of most efficient methods for killing large standing trees with hormone-type herbicide should be undertaken.

Pastures Studied

S. M. Raleigh, Pennsylvania State College, State College, Pa., headed the discussion of pastures. The group generally agreed that wild garlic can be controlled in pastures by applying 1 to 1½ pounds of an ester of 2,4-D each spring for three years and that these amounts will control susceptible pasture weeds. There was complete agreement that spraying is supplementary to adequate fertilization and good management.

The conference also noted that there is much work to be done on specific weeds such as milkweed, knapweed, vervain, horse nettle, Canada thistle, buttercup, smartweed, yellow rocket, ferns and hardtack. There was also discussion of the use of chemicals in the renovation of pastures.

Quackgrass discussion was under A. R. Hodgdon, University of New Hampshire, Durham. There was general agreement on:

1. Quackgrass can be killed effectively by appropriate treatments of sodium and ammonium trichloroacetates and suppressed by petroleum herbicides and more dilute applications of sodium TCA and ammonium TCA.
2. At present, sodium trichloroacetate (STCA) holds more promise than any other chemical in quackgrass control.
3. The plowing or disking of quackgrass areas before treatment with TCA considerably increase the effectiveness of treatment, it was added.
4. One hundred pounds or more of 90% STCA per acre is needed as a minimum dosage to bring about effective control of undisturbed quackgrass.
5. Between (25) 40 and 100 pounds of 90% STCA per acre will effectively control quackgrass if treatment is preceded by tillage.
6. Direct application of TCA to the soil is more effective than application to trash, litter or even to grass foliage and stems.
7. Since recommended rates of TCA have a residual effect on soils, sensitive crops should not be planted for probably several months after treatment.
8. Treatment with contact herbicides kills the grass to the soil surface followed by recovery slower than after cultivation.

The conference agreed that more work was necessary on:

1. Further investigation of new herbicides such as maleic hydrazide, dichloral urea and ammonium thiocyanate in quackgrass control.
2. More exact studies under controlled conditions of environmental factors and TCA treatments such as
   a. soil texture
   b. soil moisture
   c. temperature
   d. humidity
   e. time of year
3. Conditions of retention of toxicity of TCA in soil.
4. Rate of absorption and translocation of TCA
5. The relation of plant's vigor, metabolic activity, etc., to the effect of herbicide.
6. The effect of STCA and of other effective herbicides on the metabolism of the plant.

O. F. Curtis, New York State Agricultural Experiment Station, Geneva, led a discussion on orchids and vineyards. The conference generally agreed that "Ammate" should be used at one pound to the gallon for control of poison ivy in the orchard; however, it should not be used under peach trees. Retreatment is sometimes needed for poison ivy.

Dilute sprays of about 1½ to 2 pounds per 100 gallons of water of non-volatile esters of 2,4-D at low pressure are more economical than "Ammate". However, the group agreed that pears and the Stayman group of apples are extremely sensitive to 2,4,5-T and similar phenoxy herbicides. No spray or drift should be permitted to contact the foliage.

Problems which the group regarded as needing more work included methods of application that minimize danger to sensitive fruit trees, and an effective means of eliminating hedgerows.

There was also general agreement that dinitro plus oil formulations could be used safely for controlling weed growth in the row of vineyards. However, it was recommended that contact with stems less than two years old with the spray should be avoided. It was agreed that neither 2,4-D nor TCA were safe to apply in the vineyard.

Plant Work Progresses

Stauffer Chemical Company reports that the expansion program underway for over a year at its Niagara Falls Plant, is progressing on or ahead of schedule. When completed early next year, production of chlorine and caustic soda will be nearly doubled. In addition, the metal chlorides plant is being completely rebuilt and rearranged for greater production and efficiency. Facilities for the production of carbon tetrachloride have already been enlarged and are now in operation, the company states.

•

Britain Rations Sulfur

The British Government announced December 21 that sulfur and sulfuric acid would be rationed as a result of curtailment of United States exports to Britain. The order was effective January 8, 1951 to restrict the consumption of sulfur.

•

Furman New ACS President

Dr. N. Howell Furman, professor of Chemistry, Princeton University, took office as president of the American Chemical Society on January 1. In his comments upon taking office, the new president declared that further amelioration or even eradication of diseases by chemical and biochemical agents as yet undiscovered, may be possible. "The production of adequate food supplies can certainly be furthered through control of plant diseases and insect pests as well as through employment of chemical fertilizers and scientific soil conservation," he said.

The ACS head also stated that the study of photochemical processes may lead to less laborious processes for producing part of our food supplies or toward the more efficient production of certain organic raw materials.

•

Offers "Dry" Aerosol Bomb

Yosemite Chemical Co., San Francisco, has introduced a new product, "Dispercide", described as a dry aerosol bomb. The product contains 20% DDT and 5% chlordane which when started, combine to form a fog that expels the contained insecticides into space under pressure, according to the makers.

The manufacturers state that the product is not a smoke bomb, nor can it reduce the efficiency of the toxicants through fire or excessive heat. It is also claimed that two ounces of "Dispercide" contains seven times more insecticidal material than a pound aerosol bomb of conventional type.

Further information is available from the company, 1040 Mariposa St., San Francisco 7, Calif.

•

Fertilizer Sales Up

That new records for fertilizer tax tag sales were set in 1950, has been stated by the National Fertilizer Association whose Service Letter of January 11, declared that "Sales for the first 11 months of 1950 have exceeded the full year of 1949 by 244,000 equivalent tons. December figures from 12 of the 14 reporting States show an increase of 40.3 percent over December, 1949," it said.

Continuing, the letter pointed out the November figures for the 11 southern states and 3 midwestern states add up to over 10,000,000 equivalent tons. This is an increase of 9 percent over the like period last year. Gains were also registered during the fertilizer year, to date. July-November figures show a gain of 23 percent in the south, 18 percent in the midwest and 21 percent for the whole group over comparable 1949 figures.

•

Mosquito Ass'n to Chicago

The annual conference of the American Mosquito Control Association will be held at the Drake Hotel, Chicago, March 6-8. Entomologists and sanitary engineers from many sections of the U. S. and also from Canada, Mexico, Asia, the West Indies and Central and South America are expected to be present. Representatives of the army, navy, public health service, the U.S.D.A. and states will be on the program, according to Otto McFeely, chairman of arrangements for the conference. President of the National Association is Lester W. Smith, Metuchen, N. J.

Arkansas Tests Soils

In order to follow trends in soil deficiencies in the area, soil samples received at the testing laboratory of the University of Arkansas, Fayetteville, are being catalogued for the use of farm operators and agricultural officials.

Dr. Robert L. Beacher, scientist in charge of the soil testing laboratory, says that 71 counties of the 75 in the state have become active in sending soil samples for testing. The laboratory attempts to give 30-day service on all soil samples received. Farmers have been urged to send their samples in the summer and fall months when possible, to avoid the planting-season rush.

•

Fertilizer Group Book

The Association of American Fertilizer Control Officials has issued its official publication for 1950-51. The 88- page book contains a wealth of information regarding reporting systems, reports of investigators, registration forms, labels, etc., as well as the oganization's constitution and by-laws. A report of the A.A.F.C.O.'s annual meeting in Washington is included, with the texts of various talks made at the October meeting. A copy of the model state fertilizer bill is printed in full.

Copies of the publication are available for a dollar from the group's secretary-treasurer, Dr. B. D. Cloaninger, Clemson, S. Carolina. In addition to Dr. Cloaninger, other officers of the Association are R. C. Berry, Richmond, Va., president; and J. F. Fudge, College Station, Texas, vice-president.

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Enlarges Laboratory

An expansion program for its bacteriological laboratory has been announced by the Raymond C. Crippen Research & Development Laboratories, Baltimore, Md. In addition to the regular services in microbiological assay of vitamins, amino acids and other nutrients, services will now include phenol coefficients, antibiotic assays, fungicidal tests, sterility tests, as well as anti-fungal tests on mater-

ials for use in humid climates, the company states.

WORLD PESTICIDE USE

(*Continued from Page 57*)

16,000,000 gallons of lime-sulfur, and 4,000,000 pounds of cresylic type dips were used. How much of this amount will be replaced by BHC is not known, but the trend is definitely in that direction. Argentine importers are of the opinion that, when experience has been gained in the use of the new phosphatic compounds, these products will replace emulsion oils, consumption of which now amounts to around 1,500,000 gallons a year. Chlordane and toxaphene have been used experimentally and consumption may increase. 2,4-D is imported in small amounts and is expected to prove popular owing to the growing cost and lack of agricultural labor.

Argentina is among the less important export markets for United States pesticides and, contrary to the situation in other South American countries, such exports—both organics and inorganics—were less in 1949 than in 1939.

Bolivia—Consumption of pesticides in Bolivia has not shown any degree of increase in the past 10 years, but eventually a larger market may result from the much-discussed increased exploitation of that country's agricultural potentialities. Bolivia does not manufacture pesticides and the United States supplies about 60 percent of imports. Even in this small market the trend definitely is toward organic materials and U.S. exports of such commodities to Bolivia in 1949 were six times as great as in 1939, while exports of inorganic materials were only about one-third those in 1939.

Brazil—Consumption of organic pesticides in Brazil has risen considerably in recent years, with 8,100 metric tons of high-percentage materials used in 1949. Demand for new weed killers, livestock sprays, fungicides, and insecticides is already large and potential consumption is much greater. Use of new materials for the protection of the important cotton crop has increased, and lesser amounts of traditional lead arsenate are used. Domestic production of BHC in 1949 totaled 600 metric tons of 12-percent gamma isomer, while 1,600 tons of 5-percent thiophosphates, and 200 tons of 100-percent DDT were manufactured. Brazil is the second largest customer for U.S. pest control chemicals, being outranked only by Canada. According to Brazilian reports, the U.S. is the source for over 80 percent of imports, and the trend is definitely towards organic commodities. In 1939, the U. S. shipped $76,089 worth of inorganic materials to Brazil and in 1949, $94,402; but in 1949 exports of organic materials were $2,548,000 contrasted with only $93,008 in 1939.

(*Part II Next Issue*)

NEW! Betner "Duo-Tite" Bag

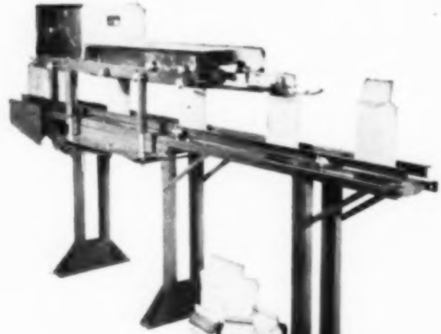
TOP & BOTTOM
Inner heat-seal plus added strength and protection of the "Duo-Tite" turnover.

If there is any bag that *positively won't* permit dry particles to sift, this is it! Betner's new method of construction combines special liners with folding, gluing and heat-sealing in such a way that there is virtually "No Sift" for contents.

This new Betner bag is perfect for insecticides, fertilizers and other chemicals that must be packaged in sift proof containers. It is also ideally suited for packaging foods. Available in sizes holding from 5 to 25 lbs. of bulk powdered material; can be preprinted up to four colors; and can be made in several combinations of materials.

and...

Betner can supply the special machinery for closing the "Duo-Tite" bag . . . it heat-seals, double folds and pastes the tops in exactly the same manner as the bottom is constructed. Your inquiries are welcome, and samples with full technical information will be supplied promptly



Benj C Betner Co DEVON, PA.

BENJ. C. BETNER of Va., Richmond, Va.; BENJ. C. BETNER CO. of WISCONSIN, Appleton, Wisconsin; BENJ. C. BETNER CO., Paris, Texas; BENJ. C. BETNER CO. of CALIFORNIA, Los Angeles, California

A complete bag service—from idea to finished bag to machinery for closing coffee bags and filling and closing liner bags for cartons.

LISTENING POST

(Continued from Page 63)

cisco to Chicago for delivery to retail florists.

Disease of Tuberoses

REPORTS from the University of California indicate that commercial plantings of tuberoses in coastal California, grown for cut flowers and bulbs, frequently develop severe spotting and blighting of the foliage and the flowers coincident with overhead watering. In some years the foliage may be blighted completely and there may even be a rot of the neck of the bulb. The flowers spotted by the fungus become unsalable, which causes considerable loss to the grower.

The disease thrives under the conditions of high humidity and cool summer temperatures prevailing on the coast near Half Moon Bay, California. Spread of the disease is facilitated by the sprinkling system of irrigation. The disease is frequently carried in the bulb in cases where the neck of the bulb has been invaded. To prove the transmission of the disease by bulbs, 100 tuberose bulbs selected for the neck lesions, and 100 healthy bulbs were planted in the field, well separated from the main field. The two experimental lots were also separated from each other by a distance of 12 feet. Counts on diseased plants were made in the middle of July and it was found that bulbs which had neck lesions gave 100 percent diseased plants, while in the apparently healthy check a few lesions were found on the leaves of ten plants and the disease was not severe.

The following season the bulbs from a large diseased field were dipped, before planting, in (a) ½ percent Lysol solution for 60 minutes, and (b) in 1:2000 solution of "Natriphene" (sodium salt of o-hydroxydiphenyl) for three hours. The treated bulbs were planted in prepared ground immediately after the treatment. A check of 500 untreated bulbs was planted in a separate field some distance away from the treated plot. The results were taken at the end of July and in September. The number of infected plants in the Lysol-treated lot was 7 percent, in the sodium salt of o-hydroxydiphenyl treated lot 3 percent, and in the untreated check 85 percent. It appears that plantings from bulbs treated either with Lysol or sodium salt of o-hydroxydiphenyl show very little disease in comparison with the check and these treatments can be recommended as control measures for this trouble.

To check the spread of the disease in the field when it had not caused serious damage to the leaves, spraying the plants with (a) ammoniacal copper 2 gal. per 100 gal. water, (b) "Greenol," and (c) sodium salt of o-hydroxydiphenyl 1:2000, held the disease under control for a maximum of two weeks after which the treatment had to be repeated.

Warns on Shortages

If the farmers of America are to be successful in attaining the increased food, feed and fiber goals set by the administration, greater consideration must be given to the needs of the fertilizer industry for critical materials, declared Dr. Russell Coleman, president of the National Fertilizer Association, Washington, in a recent statement.

"Removal of acreage allotments can mean little to crop production," said Dr. Coleman, "unless the fertilizer industry, so closely allied with agriculture, is accorded treatment with regard to supplies of sulfuric acid similar to that given other key industries such as steel, rubber and petroleum.

"Our industry's capacity is approximately 3 times that which existed in 1940, just prior to World War II. Even though fertilizer demand this year may be 20 percent greater than last year, we can come close to producing all of the nitrogen and potash required. But such increased production will not be completely effective unless supplies of sulfuric acid are made available for the manufacture of superphosphate which in turn is a key component of most fertilizers.

"Only if our leaders recognize the vital role of agriculture in America's defense and allot to it its proportionate share of critical materials can our farmers efficiently do the job assigned to them," he warned.

•

New Unloading Equipment

American Cyanamid Company has announced the installation of new equipment for the handling of sulfur and bauxite from steamship to distantly-located storage areas at its Warners Plant, Linden, New Jersey. The equipment, which includes an unloading tower and a new type of boom stacker with auxiliary conveying and distributing equipment—will handle these two materials at the rate of 600 gross tons per hour.

As an example of the added efficiency of this new equipment, a 10,600-ton shipload of sulfur, which would have taken nine days to unload with Warners' previous equipment, was unloaded recently in less than four days. It is expected that this figure will be cut to two and one half days after minor mechanical adjustments have been made.

•

Fulton Changes Personnel

Fulton Bag & Cotton Mills elected three new members to the board of directors at a meeting January 9. Those elected were E. Monroe Hornsby, manager of Fulton's New York office, who has been with the company since 1927; Norman D. Cann, attorney of Washington, D. C., associated with Fulton Bag as counsel for a number of years; and Frederick G. Barnet presently with Fulton's Dallas plant and previous to World War II connected with the Atlanta organization. Mr. Barnet is a great-grandson of Jacob Elsas who founded the business over eighty years ago.

Several changes were also made in the executive offices of the company. Benjamin Elsas was re-elected chairman of the executive committee. Norman E. Elsas was re-elected chairman of the board. Clarence E. Elsas was elected as president, succeeding William R. Elsas whose death occurred some weeks ago. Clarence Elsas previously had been vice-president. Jason M. Elsas, manager of the New Orleans plants, was re-elected vice-president. Eugene A. Cronheim, previously secretary and treasurer of the company, was named as vice-president and secretary. Julius B. Cronheim, manager of Fulton's plant at St. Louis for many years and also a director of the company, was named as vice-president. George L. Brogdon formerly comptroller was made treasurer.

•

Guano Deposits Discovered

Large guano deposits have been found in caves near Guatemala City, it is reported. Plans are now in progress to use the material as fertilizer in the vicinity. Particularly important deposits have been found near Izabal and Escuintla where the guano reaches a depth of as much as 12 feet. The deposits were discovered during a survey of the caverns as potential sources of interest for tourists.

•

Cotton Boost Snagged?

A Department of Agriculture plan to have farmers grow 60% more cotton in 1951 may fail to materialize because of the reluctance of farmers to grow more cotton unless they can be assured of the premium insecticides like benzene hexachloride and DDT, it was recently stated by a department official. To cope with this problem, the department is keeping a close watch on the military demands for insecticides in the light of the necessity for cotton this year.

The department has suggested calcium arsenate with newly devised additive mixtures. Calcium arsenate, when used alone on cotton kills boll weevils, but tends to encourage other pests. A department spokesman stated that the added compounds are expected to make short work of the other pests. However, the farmers prefer BHC and have come to rely on it in the past few years.

•

Field Crop Recommenda-

The New York State College of Agriculture at Cornell, Ithaca, N. Y. has announced publication of the recommendations for field crops in 1951. Issued jointly by the departments of agronomy, plant breeding and plant pathology, the booklet covers hay and pasture varieties, hay and pasture seedings, corn for silage, small grains, fertilizers for field crops in 1951 and chemical weed control recommendations.

•

R. B. Fudge Dies in Florida

Dr. R. B. Fudge, 50, chief horticulturist at Wilson & Toomer Fertilizer Co., Jacksonville, Fla., died Feb. 6. He was a native of Rock Hill, S. C., and a graduate from Clemson College. Before joining W-T, he had been a bio-chemist at the citrus experiment station, Gainesville, Fla., and a plant pathologist at the New Jersey station.

Cotton Proceedings Printed

Proceedings of the Fourth Annual Cotton Insect Control Conference held in Memphis, Tenn. in December, have been published by the National Cotton Council of America, P.O. Box 18, Memphis, 1, Tenn. The booklet contains the full text of speakers, as well as photos of authors and chairmen of the various sessions, and is available from the Council.

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Pesticide Service Moves

Pesticide Advisory Service, New York, has announced its recent move to new quarters at 415 Lexington Ave., New York 17. The old address was on Wall Street. Melvin Goldberg, owner, operates a combined consulting and technical service organization dealing with raw materials and related materials required in the production of agricultural insecticides, fungicides, herbicides and related materials. The firm also represents McLaughlin Gormley King Co., Minneapolis, in the eastern area, and are the exclusive agricultural sales agents for Crowley Tar Products Co., Inc., New York.

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New Name for NFA Bldg.

The National Fertilizer Association has announced that the name of its building has been changed to its original designation "Investment Building". (For the past year it has been known as the "Continental Building") The NFA office is in the same suite, 616 Investment Building, Washington 5, D. C.

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N.Z. Fertilizer Shortage

A shortage of fertilizer is in prospect for New Zealand owing to the world-wide lack of sulfur, it has been learned in the U. S. Rationing of superphosphate, the country's basic plant food and the extension of available superphosphate by ground phosphate rock or lime, were alternatives being considered, as is a long-term plan to produce sulfur by pyrites.

New Zealand had planned a production of 750,000 tons of superphosphate this year and needed 90,000 tons of sulfur to make the necessary sulphuric acid required. The allocation for the first quarter was to be 13,125 tons—to fit in with the maximum program of 52,500 tons of sulphur or 451,000 tons of superphosphate.

SUPPLIERS NOTES

(Continued from Page 66G)

the type of product being packed. Also, the company stated that it takes only a few minutes to change the auger or remove it for cleaning.

It was also announced that the packer can be supplied with single speed or two-speed motor to meet the varied requirements of users. The height of the packer is 45 inches overall, which it is stated, allows for placement under tanks, hoppers or other feed lines. Further information can be obtained by writing to the company at 5028 N. 37th Street, Milwaukee 9.

Alpha BHC Available

Pennsylvania Salt Manufacturing Co., Philadelphia has announced that it has available large quantities of "alpha beta crystal" (benzene hexachloride). The crystal is composed of 27% benzene and 73% chloride. It is expected the crystal could be broken down into its component parts by manufacturers. Thus, Pennsalt stated, the crystals should be important during times of critical shortages of benzene and chlorine.

LOUISIANA MEET

(*Continued from Page 59*)

In a discussion on the cotton situation, J. A. McDaniel, Louisiana Agricultural Extension Service assistant farm management specialist, reminded that cotton is in short supply, particularly in view of the increased demand since the Korean war began.

Edward C. Burns, L. D. Newsom, John S. Roussel and C. E. Smith of the Louisiana Experiment Station Entomology Department, and R. C. Gaines of the Bureau of Entomology and Plant Quarantine Laboratory at Tallulah, Louisiana, gave illustrated discussions on the life history and habits, description and field identification, injury and interrelations of cotton insects.

H. C. Sanders, director of the Louisiana Agricultural Extension Service, addressed the conference at the opening of the afternoon session. Sanders stated that recommendations for any practice would be followed only if materials and services were available and at reasonable prices.

Research data presented by Mr. Gaines showed that several insecticides gave almost equal control of boll weevils. Data on boll weevil control experiments presented by the Louisiana Experiment Station entomology department were in agreement and all emphasized the necessity for bollworm control. John S. Roussel reported studies showing the amount of damage done to cotton by spider mites. Severe infestations in the absence of any other cotton pests reduced the yield 40 per cent.

The results of thrips control experiments on cotton presented by L. D. Newsom showed that control measures resulted in a little more rapid and uniform growth of the seedling plant, slightly earlier fruiting, earlier maturity of a part of the crops, and little effect on the final yield. Thrips control usually resulted in slightly lower yields. Mr. Newsom emphasized that thrips control, if practiced, must be done in the two-leaf stage and could not be combined with boll weevil control. Thrips injury increased the severity of sore-shin injury on cotton.

Lewis P. Harris, Cotton States Chemical Company discussed insecticide formulations and I. J. Becnel, Freeport Sulphur Company, discussed the uses and limitations of insecticides for cotton insect control. Proper timing of applications and correct application of insecticides for successful cotton-insect control were said to be absolutely necessary in dis-

cussions by Messrs. Gaines and Roussel.

Horace Lee and Lewis P. Harris stressed the necessity of farmers getting application equipment in shape now and replacing all worn or broken parts to machinery. Where new or additional machines are needed, they urged that farmers be advised to order this equipment at once.

Strong summarized the 1951 cotton-insect control recommendations and stated that cotton growers would find it necessary to alter their programs by using materials that were available and not to wait for the particular insecticide they may prefer. He asked for cooperation on the part of industry representatives to help push the program of buying early and storing on the farm.

An address by A. C. Smith, Mathieson Chemical Company, on the relation of Louisiana Research and Extension entomology to industry, opened the program on January 10. Smith pointed out that the three could be considered analogous to an equilateral triangle with research as the base, extension as the side for promoting a practice and industry to supply the needed materials and services.

E. A. Epps, Jr., chief chemist of the Louisiana Department of Agriculture and Immigration, discussed the Louisiana Insecticide Regulations and S. J. McCrory, state entomologist for the Louisiana Department of Agriculture and Immigration, gave a report on the pink bollworm situation in Louisiana.

Sugarcane borers were discussed by E. K. Bynum, Bureau of Entomology and Plant Quarantine, and A. L. Dugas, Louisiana Experiment Station Entomology Department. Mr. Dugas presented data for 1950 showing some better control of the sugarcane borer with Ryania than with cryolite.

C. E. Smith gave recommendations for stored grain insect control, general field crop pest control, and control of insects on ornamental and flowering plants. K. L. Cockerham, Bureau of Entomology and Plant Quarantine, gave recommendations for the control of truck crop insects.

IPC HERBICIDE

(*Continued from Page 37*)

others reported a consistent dwarfing effect of 5 pounds IPC per acre on beets.

Cotton. No reports were available showing successful field use of wettable IPC in cotton, nor was trial data on field experience with the emulsifiable form of IPC in cotton. However, Leonard (8) reports on 1949 fields trials in Mississippi using the 3-Chloro derivative (5) of IPC for control of crabgrass. Results of pre-emergence applications in oil (seen below) are in terms of actual 3-Chloro IPC per acre, yields in pounds of seed cotton per acre, and control in percentage of total soil area having crabgrass at harvest:

Check: no treatment 292 lbs., 90% of soil covered with crabgrass.
1.7 lbs. rate ——— 825 lbs., "trace"
3.3 lbs. rate ——— 605 lbs., none
6.6 lbs. rate ——— 660 lbs., none.

Harvey(2) concludes dry hot soils in California Interior Valleys are responsible for poor results with wettable form of IPC in cotton to date. Further and intensified trials are progressing with other new forms of IPC, for which better results seem possible.

Peas. Seely(4) provides complete field data covering 2 years use of wettable IPC to control wild oats in field peas, mostly of the Alaska variety. Application at pre-planting of peas was superior in results to pre-emergence applications. Applications of 1, 2 and 4 pounds per acre were used in both dust and spray form. Spray proved better than dust applications, although dusting has possibilities where water for spraying is limited.

Two methods of working the IPC into soil were used: a) standard seed bed preparation of discing and harrowing and b) rototilling and harrowing. The 1950 work demonstrated that IPC sprays killed more wild oats than IPC dusts and that discing gave both higher yields of peas and better kills of wild oats than the rototilling. The following results are given in terms of rates of actual IPC per acre, yields in terms of pounds of dry clean peas per acre, and percentages of kills of wild oats:

Untreated checks,— 580 lbs peas;
1 lb. IPC ——— 860 lbs. peas—43% control
2 lbs. IPC ———1040 lbs. peas—67% control
4 lbs. IPC ———1550 lbs. peas—86% control

Bucholtz(17) reports 5 pounds IPC per acre applied directly after planting soybeans and peas reduced stands of wild oats with no ill effect on soybeans or peas. At rate of 20 pounds, wild oats were nearly eliminated and soybeans and peas reduced by at least 50%.

Flax, and Safflower. Arle(3) reports good wild oats control in flax with 2 and 3½ pounds actual IPC per acre, using the wettable form. Best results came when material was applied before many of the oats were above ground. Flax was at the 4-5 true leaf stage. In safflower, 3 pounds of IPC gave complete control of wild oats and volunteer barley, applied when the safflower was passing the cotyledon stage. Harvey (2) describes IPC control of wild oats in flax in Imperial Valley as generally good. Most important factor was to get wild oats soon as possible after their germination but not before the flax is at its 4-5 leaf stage. Flax may exhibit some varietal variations of IPC tolerance.

Bulbous Crops. Baur(10) advised that pre-emergence use of 4 pounds IPC combination with 1 quart of dinitro general and 60 to 80 gallons of diesel oil per acre gave excellent control of annual blue grass, chickweed and wild vetch, in daffodil and narcissus bulb crops. Treatments reduced former high weeding costs.

Freed(1) and many Oregon bulb growers report effective control of many weeds in bulbs with pre-emergence application of 3 to 8 pounds of IPC per acre, depending upon the weeds involved. Gladioli will stand 4 pounds post emergence in Oregon. Freed(1) suggests using IPC with contact weed killer such as dinitro general or calcium cyanamid to control both grasses and broadleafed weeds.

Alfalfa. Jones(11) reported alfalfa germination and emergence normal following pre-emergence IPC treatment at 1 to 4 pounds per acre. Application of 4 to 5 pounds caused some stunting of alfalfa seedlings through second trifoliate leaf stage. At 6 to 12 pounds, some alfalfa seedlings were killed. Wild oats were completely controlled with IPC at 1 to 12 pounds when the material was applied before germination. IPC at 3 pounds in 140 gallons of water per acre gave good control of wild oats in the 2 to 4 leaf stage. These rates caused no ill effect on 6 week old alfalfa seedlings nor on established stands. Yield trials where grasses made up more than 50% of the plant growth, indicated that 3 pounds IPC per acre controlled 90 to 98% of the grasses and increased the yield of alfalfa more than 50% over the untreated areas.

Aldrich(9) says that forage yields of alfalfa taken in 1950 from a field treated with 10 pounds of IPC per acre in November, 1949, showed an increase of 25% over the untreated plot. Johnson (12) confirms effectiveness of IPC applied at from 4 to 16 pounds per acre to seedling alfalfa in the 3 leaf stage with almost complete control of Little Barley (*Hordeum pusillum*). No injury to seedlings was noted. Late fall applications of 4 pounds per acre gave good control of Bromus species present. Freed(1) recommends late fall to early spring applications at rates of 2 to 4 pounds IPC per acre before emergence of weeds, or 4 to 8 pounds post emergence. Preference is indicated in Oregon for the emulsifiable form of IPC for control of perennial grasses, but no special preference is given between the wettable or emulsifiable forms for pre-emergence control of annual grasses. Late IPC treatments for annual grasses, or when grasses are emerged, might better be applied in the emulsifiable form.

Mint (For Oil Distillation). Freed(1) reports that many grasses and some broadleafed weeds, and especially Water Bent (*Agrostis verticilliata*) which crowds out mint, can be controlled with 6 to 8 pounds of IPC, applied in 80 to 100 gallons of diesel oil per acre. For this job it is essential to use the emulsifiable form of IPC. Spraying is done shortly after the mint is spring plowed. Freed(1) states in Oregon State College Station Bulletin 483, under general discussion of perennial grass control, that it is essential to use oil as a carrier for IPC when attempting to control the perennial grasses.

Clovers. Jones(11) reports a series of 2 acre plots of established

Ladino clover that was overrun with grasses sprayed with IPC. Grasses present were foxtail *(Hordeum murinlm L.)*, annual blue grass *(Poa annua)*, and perennial ryegrass *(Lolium perenne)*, annual ryegrass *(Lolium multiflorum)*, and fescue *(Festuca sp.)*. Sprayed in January with 3 pounds IPC per acre, all the seedling grasses were killed. The old clumps of perennial ryegrass and fescue were reduced in size and growth retarded. The clover was not injured and the pasture mixture was restored to a ratio of 30 per cent grass to 70 per cent clover. The clover seed yield was nearly three times that of the untreated. Bohnert(6) made the first IPC commercial application on seed crop of Ladino clover, in Jackson County, Oregon, in 1946. Control of perennial ryegrass was nearly complete. Annual grasses were killed as well as good control on several perennial grasses. He has used IPC in successive years since and considers it one of his best practices in all of his seeds vegetable crops. Freed(1) is recommending dosage rates for Oregon as listed below, taken from Oregon State College Station Bulletin 483.

	Tolerance to IPC			
Clovers	Pre-Emergence rate per acre lbs.	Post emergence rate per acre lbs.	Suggested time of application	Suggested Forms of IPC for use
Alsike	2 to 3	4 to 6		Emulsifiable
White	2 to 4	3 to 5		Form
Crimson	2 to 3	3 to 5	Early spring	most
Ladino	2 to 4	4 to 8	Late fall or winter	convenient
Sub	2 to 4	3 to 5	Early spring	Wettable Form
Red	2 to 3	3 to 5	Early spring	safest

In the forthcoming California Exp. Sta. Bulletin on Clover Production in California, recommendations for use of IPC are substantially as those for Oregon, with added use of 2,4-D (late spring) for control of dock *(Rumex sp.)* and plantain on "buckhorn" *(Plantago sp.)* where conditions are suitable and safe for 2,4-D use.

Strawberries. Freed(1) paved the way for the present standard practice of weed control with IPC and 2,4-D in strawberries. IPC at 6 to 8 pounds per acre with 1 pound 2,4-D acid equivalent is standard fall or winter procedure in most strawberry plantings on the West Coast. Carlson(13) early demonstrated the value of IPC in controlling chickweed, annual blue grass and other annual grasses in strawberries in Michigan, as did several investigators in other parts of the country. Harvey(2) reports the Extension Service in Santa Clara County demonstrates control of "Wiregrass", purslane and annual grasses by fall pre-emergence application of 4 pounds IPC per

acre. Seedling strawberry plants set out immediately after IPC treatment grew normally. Thomas(16) controlled "bronco" or foxtail millet *(Setaria sp.)* with 6 pounds IPC per acre of wettable IPC in a strawberry nursery and fall applications made on pre-emergence schedule showed bare ground through the spring season. IPC applied in water when grasses were four to six inches tall showed no effect for four months — then complete and sudden browning and falling over of the grasses in month of April. Danielson(18) has done considerable amount of weed control work in many crops and is presently conducting extensive trials with the 3-Chloro IPC in strawberries. The 3-Chloro IPC is being trial tested in numerous areas on strawberries for possible longer residual life and other possible advantages permitting use under temperatures higher than feasible with the wettable form of IPC.

Vegetable Crops. The following vegetable crops are fairly tolerant to IPC at rates, post emergence, from 4 to 5 pounds per acre: table beets, chard, cauliflower, cabbage, carrots, onions, garlic, radish, spinach, and turnip. Lettuce will usually tolerate 2 to 3 pounds IPC pre-emergence and up to 4 pounds post-emergence under coastal weather conditions. Asparagus, early spring application before spikes appear seems not to be affected by relatively heavy applications of IPC. Bud emergences will stand four pounds IPC per acre but the maximum limits have not yet been fully explored. More specific field experience is needed with IPC on vegetables before any useful program can be established. Cucurbits, pumpkin, squash, melon, and cucumbers are only slightly tolerant to IPC, and it is not suggested IPC be used on such crops.

Acknowledgements

It would be extremely difficult in an article of this kind to do even partial justice to the many Federal, State and Country Agents contributing to the increasing knowledge of IPC. However, the writer extends thanks with grateful acknowledgements to those who have contributed opinions, information and photographs for these notes:

(1) Freed, Virgil H., Assoc. Agronomist & Assoc. Chemist, Oregon State College, Corvallis, Ore.

(2) Harvey, WM. A., Extension Weed Control Specialist, Univ. of California, Davis, Calif.

(3) Arle, H. Fred, USDA., Agr. Res. Admn., B.P.I., Phoenix, Arizona.

(4) Seely, C. I., Agronomist, Weed Investigations, Univ. of Idaho, Moscow, Idaho.

(5) Columbia Chem. Div., Pittsburgh Plate Glass Co., Pittsburgh, Pa.

(6) Bohnert, Otto—Seedsman, and first US grower to use IPC commercially, Central Point, Ore.

(7) Campbell, Sam C., Mgr. West Coast Beet Seed Co., Salem, Oregon.

(8) Leonard, Oliver A. Div. of Botany, Univ. of Calif., Agr. Exp. Sta., Davis, Calif.

(9) Aldrich, Richard J., Agent, Weed Investigations, USDA, Agr. Res. Admn. B.P.I. New Brunswick, N. J.

(10) Baur, Karl, Assoc. Soil Scientist, State College of Washington, Western Wash. Exp. Sta., Puyallup, Wash.

(11) Jones, Luther G., Assoc. Specialist in Agronomy, Univ. of Calif., Agr. Exp. Sta., Davis, Calif.

(12) Johnson, Howard W., Sr. Pathologist, USDA, Agr. Res. Admn. B.P.I. Delta Exp. Sta., Stoneville, Miss.

(13) Carlson, Robt. F., Asst. Prof. in Res., Mich. State College, East Lansing, Mich.

(14) Carstens, Martin W., Supt. & Assoc. Hort., State College of Wash. Northwestern Wash. Exp. Sta., Mount Vernon, Wash.

(15) Lachman, Wm. H., Jr., Asst. Prof. in Res., Mass. Agric. Exp. Sta., Amherst, Mass.

(16) Thomas, Harold E., Plant Pathologist, Strawberry Institute, Morgan Hill, Calif.

(17) Buckholtz, K. P., Assoc. Prof. of Agronomy, Univ. Wis., Coll. Agric., Madison, Wis.

(18) Danielson, L. L., Plant Physiologist, Virginia Truck Exp. Sta., Norfolk, Va.

INSECTICIDES

(Continued from Page 40)

wide cotton insect control experiments conducted in Central Texas in 1949. Nineteen adjoining fields on 6 farms in one community were dusted or sprayed (mostly 20 percent toxaphene or a dust mixture containing 3 percent gamma BHC, 5% DDT, and 40% sulfur) for insect control for comparison with 14 fields on 4 farms in an adjoining community that received no insecticides. As a result of boll weevil control, the yield in lint cotton was 415 pounds per acre from the treated cotton, as compared with only 178 pounds from the untreated fields. The net profit was about $54 per acre.

For many years the arsenicals, nicotine and rotenone insecticides were used against potato pests, with only reasonably satisfactory results. DDT, in one form or another, is now generally used on the potato crop in the United States, with the result that potato production on a per acre basis has increased materially. For example, 85% of the potato acreage in Maine was treated with DDT for insect control and the production of potatoes rose from 261 bushels per acre in 1945 to 358 in 1946. Since that time the production has been 350, 385, and 450 bushels per acre for 1947, 1948, and 1949, respectively.

Prior to the availability and use of DDT in 1946, annual apple losses due to codling moth amounted to about 15 percent of the value of the crop; now the average is around 3 or 5 percent. In spite of this advancement, losses due to the codling moth for the 5 years 1944-48 amounted to $9,176,000.

Problems Grow Over Years

FOR a full century, chemical control of insects has been practiced extensively. Almost from the beginning, entomologists have given consideration to side effects resulting from the application of insecticides for pest control.

The rapidly expanding agriculture of this country associated with the reclaiming of the wilderness and the multiplication of our population has been beset by ever increasing problems in insect control. One of the necessary and effective

weapons employed against this ever increasing army has been insecticides.

With the appearance of new crop or livestock pests, either native or accidentally introduced, the demand for more effective and economical insecticides has increased. The repeated assaults of foreign insect invaders have been halted or delayed and in most cases the effects of attacks have been minimized. In all of these campaigns insecticides have been one of the most dependable weapons. These weapons are recognized as imperfect and in some instances ineffective.

Toxicants

INSECTICIDE use has always been attended with problems aside from those concerned directly with the pest itself. These side problems have been brought to the fore more forcefully during the last 5 years with the appearance of a considerable number of new and effective chlorinated hydrocarbon and phosphate compounds and hundreds of formulations of them. In research and development work with these newer compounds an effort has been made, as has been the case with all insecticide development from earliest times, to evaluate these side effects and avoid or minimize those regarded as undesirable.

What are the factors to be considered in evaluating an insecticidal chemical? Here are some of the questions which must be answered:

1. How effective is the insecticide in killing or repelling pest insects?
2. Which insects are killed by it? Which ones are little affected by it?
3. Will it injure plants by direct application?
4. Will it injure plants through the soil?
5. Which plants are resistant and which ones are susceptible?
6. What is its acute toxicity to a variety of higher animals?
7. What is its chronic toxicity when applied in different ways and in different formulations?
8. What is the effect of the material on fish, wildlife, bees and other beneficial forms of life?
9. In what formulations can it be used and stored effectually and most safely?
10. What is the extent and persistence of the material as a residual insecticide on various surfaces and under diverse conditions?
11. What types of equipment are most satisfactory for applying it in its many formulations to assure good kills of various pests on different crops, under diverse conditions, and at the same time avoid hazards to the operator, to people in the area and crop contamination?
12. Can the chemical be employed satisfactorily with other insecticidal or fungicidal materials?
13. Can the chemical be produced, formulated and applied at a cost consistent with increased yields and higher quality crops, resulting from its use?

Each of these points and others are considered and investigated during the evaluation and development of an insecticide. In evaluating and developing insecticides, in their packaging and labeling, and in their application by officials or custom operators, there is usually close cooperation between the various agencies and industries concerned.

We realize that all these questions are not fully answered before an insecticide is put on the market.

As a matter of fact, to get complete answers years would be required. We must, in the writer's opinion, gather enough information regarding a new material to make sure of the major points regarding effectiveness and safety, then by proceeding on the conservative side gradually develop that complete and desirable picture.

It is recognized that officials charged with the protection of the public from hazards connected with the use of economic poisons have an important responsibility. So do those in industry and especially in Federal and State organizations who recommend such materials and procedures for their use. Another responsibility which government officials can not ignore is the development and recommendation to the public of pesticides that will control insects to such a degree that adequate protection will be afforded to our forests, our food, and our health. There are many problems connected with this important field of activity and I am convinced that the only way to meet them, so that the greatest good for all will be realized is through cooperative effort.

Needs Pointed Out

THERE is obviously need for accelerating research in all aspects of insect control by the use of insecticides. Toxicology of many insecticides from the standpoint of soils, plants, beneficial insects and higher animals requires more attention. Methods of analysis especially for the detection of minute qualities of such insecticides as chlordane and toxaphene should be developed. Improvement of insecticide formulations and equipment for applying them so as to increase their efficiency and reduce hazards are recognized needs.

More attention is now being given to means of insect control without the use of insecticides. Modified agricultural practices, biological control, the use of mechanical devices and the development of insect resistant varieties are being investigated and their employment by the public is being stressed. Additional research along these lines is urgently needed. More educational work to inform the public as a whole on the need for insecticides, and on their effective and safe use is a necessity.

The passage of more effective and uniform State laws governing the labeling and application of insecticides appears to be desirable.

Some Conclusions

THERE is not a farmer, cattle raiser, dairyman or householder who would not like to avoid the use of insecticides. However, there are few crops which could be profitably grown year after year without the use of insect killing agents. Also there are few localities and few homes in which the use of insecticides or repellents is not desirable for comfort and/or the protection of food, fabrics or buildings.

The evidence seems to establish the following facts:

(1) In order to have an adequate supply of wholesome food we must have insecticides, proper equipment, and correct usage.

(2) That the control of insects such as mosquitoes, house flies, horse flies, sandflies, fleas and lice is essential if man is to avoid serious annoyance and such debilitating and deadly diseases as malaria, dysentery, typhus and plague.

(3) That the control of these pests demands the use of tremendous quantities of insecticides of many kinds.

(4) That the widespread use of insecticides is attended with distinct hazards.

(5) That these hazards have been and are being recognized.

(6) That despite the extensive use of insecticides there have been relatively few cases of human illness or death due to the insecticides *per se*.

(7) That there is need for more research on the chemistry and toxicology of insecticides.

(8) That there is great need for educational work relating to insect control and especially to insecticides and their safe use.

(9) That more attention should be given to methods of insect control other than by the use of insecticides.

(10) That great progress in the war against insects has been made especially during the last few years resulting in the protection of our forests and food crops, as well as the saving of many lives.

(11) That close cooperation is essential between officials concerned with work on insecticides, including their development, manufacture, labeling, distribution, storage, application and control. This cooperative effort in-

volves those charged with the enforcement of laws relating to every phase of the insecticide industry.

(12) Although there is evident need for more adequate and uniform State laws governing the manufacture, labeling and application of insecticides it appears that existing laws and cooperative efforts have given satisfactory protection to the manufacturer, the user, and the general public.

(13) And, finally, that despite the great gains in crop production, the improvement of health and saving of lives credited to insecticides, their improper use presents real hazards which all must recognize and guard against. However, there is no evidence of any serious condition which cannot be corrected with education and the application of the accepted and logical principles of insecticide use.

FUNGICIDES

(*Continued from Page 43*)

been added to one equivalent of copper sulfate.

At this point all of the copper sulfate will have reacted with the calcium hydroxide and further additions of the alkali will cause decomposition of the basic sulfate and the formation of a blue hydrated cupric oxide. This is in the nature of a gelatinous precipitate when freshly formed. The precipitate tends to crystallize on standing. For this reason bordeaux mixture sets up more quickly and adheres more tenaciously if applied immediately after the components are combined in the spray tank than it does after long standing.

Attempts by industry to produce low soluble or fixed copper fungicides equally as effective as bordeaux mixture have been only partially successful. None of them that have come to my attention will set up as quickly in spray residues or adhere as tenaciously. However, all of them are more convenient and pleasant to use and most of them are less injurious to copper sensitive plants. Because of this, they have encroached on markets formerly dominated by bordeaux mixture and they have extended the market for copper fungicides into fields beyond the reach of bordeaux. The fixed coppers such as the basic copper sulfates, the oxychlorides and cuprous oxide, to mention only a few, are serving agriculture usefully and, like bordeaux mixture, they will be with us for many years to come.

Organic Fungicides

Dithiocarbamates. Of the organic fungicides, the dithiocarbamates have given sulfur and copper their keenest competition. Made by the treatment of substituted primary and secondary aliphatic and aromatic amines with carbon bisulfide, followed by treatment with an appropriate metal salt, the dithiocarbamates are reasonably cheap, dosage basis, and they do some jobs better than either sulfur or copper. In some spray programs they are used to supplement sulfur and copper; in others they substitute for one or the other or both. For example, a combination of sulfur and ferric dimethyl dithiocarbamate may be used in the early season spray on apple for

the combined control of scab and apple cedar-rust. In this capacity, both materials together are better than either material alone.

The fungicidal properties of certain derivatives of dithiocarbamic acid were discovered in 1931. Certain of these materials were then being used as rubber accelerators. They have gained importance as agricultural fungicides only during the past decade. At least four of the dithiocarbamates are worthy of mention.

Ferbam (ferric dimethyl dithiocarbamate) is a dark, microfine wettable powder that is now firmly established in many of our apple and pear spray programs, and it finds a receptive market on certain other deciduous fruits. It is used for the control of cranberry fruit rots and is a favorite with tobacco growers for the control of blue mold in the seed beds. It has not shown up to good advantage on peach nor has it gained favor with vegetable growers.

Ziram (zinc dimethyl dithiocarbamate) is a whitish microfine wettable powder that finds its best market on vegetable crops.

Nabam (disodium ethylene bis-dithiocarbamate is a liquid fungicide that performs best when combined in the spray tank with a small amount of zinc sulphate and hydrated lime. It finds the bulk of its market on vegetables where it competes with copper and with ziram.

Zineb (zinc ethylene bis-dithocarbamate) is a microfine wettable powder that, like ziram and nabam, finds the bulk of its market on vegetable crops. It is the fungicidal equivalent of nabam plus zinc sulphate and hydrated lime. However, both the liquid and the wettable powders have their proponents, and both nabam and zineb will probably continue to be merchandised.

All of the above products are somewhat specific in their fungicidal action—probably more so than either sulfur or copper. However, they differ sufficiently in their specificity so that each finds preferred uses. They are effective at relatively low dosages in conventional sprays and for this reason ferbam, ziram and zineb are well suited for use in concentrate sprays. The dithiocarbamates should find an expanding market.

Glyoxalidine Derivatives

INDUSTRY and research have not been content to turn the fungicide market entirely over to sulfur, copper and the dithiocarbamates. During the past few years, several heterocyclic nitrogen compounds (glyoxalidine derivatives) have been offered to the trade as fruit fungicides. One of these, made by reacting ethylene diamine with stearic acid, has been offered to fruit growers both in liquid and wettable powder formulations. The liquid formulation, designed for use on apple for the control of scab, is an excellent protective fungicide, but a weak eradicant. It has found favor among apple growers in the New England states for the control of scab but is having phytotoxic troubles elsewhere.

S. A. Rohwer Dies; Long With USDA

DR. Seivert A. Rohwer, 63, assistant chief of the U.S.D.A. Bureau of Entomology and Plant Quarantine and recently named special assistant for defense in the Agricultural Research Administration, died unexpectedly at the Department of Agriculture building in Washington, Monday evening, February 12. Dr. Rohwer was widely known throughout the agricultural chemical field both in industry and government, and had been on the editorial advisory board of *Agricultural Chemicals* since the magazine started publication in 1946. He was a familiar figure at industry meetings, appeared on programs frequently either as a scheduled speaker or upon request of chairmen on short notice.

Dr. Rohwer spent his entire career with the U. S. Department of Agriculture which he joined in 1909, as entomologist in charge of taxonomical investigations. This position he held until 1928, at which time he became assistant chief of the Bureau of Entomology and Plant Quarantine.

His last assignment involved more responsibility than any of his many previous ones. Dr. P. V. Cardon, ARA administrator had appointed him as special assistant for defense where Dr. Rohwer would be the administrator's special representative in spearheading ARA defense efforts in the present emergency. He represented the administrator in relationships with the Production and Marketing Administration under the Defense Production Act and activities coming within the purview of the National Security Resources Board. The assignment made him ARA liaison officer with the Federal Civil Defense Administration and with the Munitions Board and the Research and Development Board of the Defense Department.

Such wartime activities were not new to Dr. Rohwer, however. During World War II, he presented the needs for insecticide chemicals to the War Production Board, representing the farmers and the insecticide industry. For his service during the war, he was awarded the Superior Service Award by the Secretary of Agriculture in 1947.

In addition to his service with the Department of Agriculture and other government agencies, he was also prominent in scientific organizations. He served one term as president of the American Association of Economic Entomologists, and held office in other associations over the years.

S. A. ROHWER

A native of Telluride, Colorado, he attended the University of Colorado which honored him with a Doctor of Science degree in 1948.

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Appoints New Branch Mgrs.

The appointment of George A. Seaver as manager of the New York City branch and William H. Leland as manager of the Newark, N. J. branch, has been announced by the Howe Scale Company, Rutland, Vermont.

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Am. Potash Dividend

The board of directors of American Potash & Chemical Corporation has declared a quarterly dividend of 50 cents per share on the Class A stock and the Class B stock of the corporation, payable March 15, 1951, to the holders of record on March 1, 1951.

The board also declared a quarterly dividend of $1 per share on the Preferred Stock, payable March 15, 1951, to the holders of record on March 1, 1951.

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New Pacific Coast H.Q.

Establishment of west coast regional headquarters at 733 East Pico Blvd., Los Angeles, has been announced by The Bellows Co., Akron, Ohio, manufacturers of Bellows "Controlled-Air-Power" Devices for industrial use.

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Monsanto Moves Weddell

Dr. David S. Weddell, director of development for Monsanto Chemical Company's Western Division, of Seattle, Wash., will rejoin the company's General Development Department in St. Louis Mo., to carry on some of the department's major project investigations, it has been announced by W. K. Menke, director of the department.

Dr. Weddell, who assumed his Western Division responsibilities in March, 1949, joined the company in 1941 after receiving a Sc. D. degree in chemical engineering from Massachusetts Institute of Technology.

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New Kansas Bulletin

Kansas State College Extention Service, Manhatten, Kansas, has recently published a bulletin by L. E. Melchers entitled "Bunt Control in Kansas". The bulletin covers a 35 year period of experimentation on the control of bunt or stinking smut of wheat in Kansas. The review covers the various treatments tried and experimentation that resulted in the final program of breeding disease resistant strains of the wheat plus the use of new, effective specifics for bunt and treatment of seed.

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New Office for Goodrich

The New York sales office of B. F. Goodrich Chemical Company has moved into new facilities in the Farmers Loan and Trust Company Building, 475 Fifth Avenue. Occupancy of the entire 24th floor will provide additional offices and conference rooms necessitated by expanding operations. The officers have been located in smaller quarters in the same building since 1949.

"I believe every company should . . ."

MR. CLARENCE FRANCIS

Chairman of the Board, General Foods Corporation

"I believe every company should conduct a person to person canvass right now, for the best way to promote the sale of U. S. Savings Bonds is to put an application card into each employee's hand and allow him to reach his own decision."

As one of America's top executive salesmen, Mr. Clarence Francis knows that you sell more when you "ask the man to buy." Naturally, that means a person to person canvass of *all* your employees, but it is not as difficult as it may sound. In fact, it is very simple:

Tell your employees personally—or over your signature—why the automatic purchase of Savings Bonds through the Payroll Savings Plan is good for them and their country.

Designate your Number One Man to organize the canvass and keep it moving.

Enlist the aid of employee organizations—they will be glad to cooperate with you.

With posters, leaflets, and payroll envelope enclosures remind your employees of the many benefits of the Payroll Savings Plan. Your State Director, U. S. Treasury Department, Savings Bonds Division, will furnish you, free of charge, all the promotional material you can use.

Be sure that every man and woman on the payroll is given a U. S. Savings Bond Application Form.

Thousands of companies, large and small, have just completed or are now conducting person to person canvasses. Their reports are a challenge to every company that does not have a Payroll Savings Plan . . . 50% employee participation . . . 60% employee participation—some of them have gone over 80%.

All the help you need to conduct your person to person canvass is available from your State Director, U. S. Treasury Department, Savings Bonds Division. Get in touch with him.

The U. S. Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the G. M. Basford Company and

AGRICULTURAL CHEMICALS

The wettable powder formulation has found a ready market on sour cherries for the control of leaf spot. This product is less fungicidal and also less phytotoxic to foliage and fruit than the liquid formulation. When first tested on apple it was rated as being safe but inadequate for use in the control of scab. However, current formulations have given excellent control of apple scab in some tests with no injury to foliage or fruit. It is quite possible, therefore, that the wettable powder will find a place in our apple spray programs as it already has on cherry.

Phenyl Mercury Compounds

OF the new organic fungicides, the phenyl mercury compounds such as phenyl mercury acetate and phenyl mercury triethanol ammonium lactate, have proved to be excellent eradicants and poor protective fungicides. Properly used on apple, they have shown to excellent advantage in the control of scab; improperly used, they can result in crop losses. Growers who have tried to use them to the exclusion of protective fungicides have frequently met with disastrous results. Others who have used them as a supplement to a good protective spray program have often profited from their use.

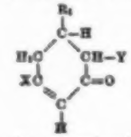
To be effective as scab eradicants the phenyl mercury fungicides must be applied before the fungus has pentrated deeply into the plant tissues. Usually the apple grower has a maximum of about three days to spray his orchard following any given infection period. If he does not finish in that time the treatment is usually ineffective. Many orchardists now take a week or more to make a single spray application. Unless or until they are prepared to do the job within three days, regardless of weather, they will probably be well advised to rely on protective fungicides as the mainstay of their spray programs.

2,3-Dichloro-1, 4-Naphthoquinone

ONE more product should be mentioned. It is 2,3-dichloro-1, 4-naphthoquinone, sold under the trade name of "Phygon." Since this product has no good common or generic name, use of the trade name is necessary. It is worthy of mention because it combines good eradicant with good protectant properties. It is effective against a large group of fungus pathogens. Unfortunately, it is somewhat phytotoxic and it is a skin irritant, especially in hot weather. It is one of the few, if not the only, fungicide that is more effective than bordeaux mixture in the control of bitter rot on apples. However, it causes a dark chromatic spotting of fruit wherever there is a hanging drop, and the spray crews don't like to apply it in hot weather. It is finding a place in the early sprays on apple as a competitor of both the eradicant and the protective fungicides. Because of its good fungicidal properties it will probably continue to be used on those crops at such times as its price, phytotoxic and irritant properties will permit.

Industry Patents

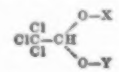
2,524,108. Insecticidal Composition Comprising Pyrethrins and a Synergist Therefore. Patent issued October 3, 1950 to Oscar F. Hedenburg, Pittsburgh, Pa., assignor to Harold W. Moburg, Toledo, Ohio, trustee. An insecticide composition containing pyrethrins and a compound of the generic formula in which R_1 is the



3,4-methylenedioxyphenyl radical, X is a substituent selected from the group consisting of alkyl radicals having from two to eleven carbon atoms and octenyl radicals, and Y is a substituent selected from the group consisting of hydrogen and in

which R is a substituent selected from the group consisting of alkyl radicals having from one to six carbon atoms, the cyclohexyl radical and the n-butoxyethyl radical.

2,528,139. Insecticides. Patent issued October 31, 1950, to Walter D. Harris, Naugatuck, and Theodore W. Kerr, Seymour, Conn., assignors to United States Rubber Co., New York, N. Y. An insecticidal composition comprising as an active ingredient a compound having the general formula in which X is a radical



selected from the group consisting of alkyl, cycloalky, haloalkyl, cyanoalkyl, alkoxyalkyl radicals having up to 12 carbon atoms and Y is a radical selected from the group consisting of phenyl, naphthyl, halophenyl, nitrophenyl, alkylphenyl, and alkoxyphenyl radicals having 6 to 10 carbon atoms, and a carrier therefor.

2,529,493. Chloroalkyl Sulfites as New Chemicals and Insecticides. Patent issued November 14, 1950 to Walter D. Harris, Naugatuck, Herman D. Tate, Woodbridge, and John W. Zukel, Hamden, Conn., assignors to United States Rubber Company, New York, N. Y. 3-chloropropyl lauryl sulfite.

2,529,494. Chloroalkyl Alkyl Sulfites as New Chemicals and Insecticides. Patent issued November 14, 1950 to Walter D. Harris, Naugatuck, Herman D. Tate, Woodbridge, and John W. Zukel, Hamden, Conn., assignors to United States Rubber Company, New York, N. Y. A composition comprising a di-ester of sulfurous acid wherein one of the esterifying groups is a radical of the formula R—O—X—, wherein R is selected from the class consisting of monovalent aryl hydrocarbon radicals and such radicals substituted by at least one member of the group consisting of alkyl, alkoxy, cycloalkyl, halo and nitro, and X is an alkylene radical having 2 to 4 carbon atoms, and wherein the other esterifying group is a monochloroalkyl radical containing 2 to 4 carbon atoms in which at least one hydrogen atom is attached to the alpha carbon atom and in which the chlorine atom is atttached to a carbon atom other than the alpha carbon atom, and a surface-active dispersing agent.

2,529,681. Fused DDT Compositions Containing an Absorbent Inert. Patent issued November 14, 1950 to Albert L. Flenner, Wilmington, Del., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del. The method which comprises heating DDT to a temperature above fusion but below about 110° C. and gradually feeding the fused DDT, in proportions to give a dry product, into a mass of a finely divided absorbent inert solid powder while maintaining the temperature of the absorbent powder above the fusion temperature of DDT but below 110° C. and while stirring the powder to effect a mixture of the fused material and the absorbent powder, the rate of addition of the fused DDT into the absorbent powder being controlled so that the mixture remains as an apparently dry powdered solid thruout the addition and mixing operation.

2,529,682. 2,2- Bis (4-Methoxyphenyl)-1,1,1-Trichloroethane Insecticidal Dust and the Process for Making Same. Patent issued November 14, 1950 to Albert L. Flenner Wilmington, Del., assignor to E. I. du Pont de Nemours & Company, Wilmington, Del. The method for preparing an insecticidal dust composition containing 2,2-bis(4-methoxyphenyl)-1,1,1-trichloroethane as an essential active ingredient which comprises gradually introducing the 2,2-bis(4-methoxyphenyl)-1,1,1-trichloroethane in a fused state at a temperature above 90° C. but below about 115° C. into a mass of adsorbent powder while agitating the powder to effect a mixture of the fused material and the adsorbent powder, the rate of addition of the fused 2,2-bis(4-methoxyphenyl)-1,1,1-trichloroethane into the adsorbent powder being controlled so that the mixture remains as an apparently dry pulverulent solid thruout the addition and mixing operation, and continuing the agitation following completion of the addition of the fused 2,2-bis(4-methoxyphenyl)-1,1,1-trichloroethane while cooling the mixture to a temperature not in excess of about 50° C., whereby there is obtained a free-flowing dust product characterized by having the 2,2-bis-(4-methoxypheny)-1,1,1-trichloroethane absorbed in the pores and on the surfaces of the adsorbent powder.

2,530,653. Benzhydryl Esters as Insecticides. Patent issued November 21, 1950 to Peter L. de Benneville, Philadelphia, Pa., and Howard D. Segool, Flushing, N. Y., assignors to Allied Chemical & Dye Corporation, New York. An insecticidal composition comprising a compound having the structural formula

in which A and A' each denote the phenyl radical, R denotes a member selected from the group consisting of alkyl groups and halo-alkyl groups containing not over 6 carbon atoms and Y denotes a radical selected from the group consisting of the radicals—OCO—and—$(OCH_2CH_2)_n$OCO—*n* denoting a whole number from 1 to 3, dispersed in an aqueous emulsion.

2,530,770. Fungicidal Composition. Patent issued November 21, 1950 to Sever L. Hopperstead, Brighton, Mich., assignor to B. F. Goodrich Company, New York. A fungicidal composition containing as the essential active ingredients polyethylene polysulfide and lauryl isoquinolium bromide dispersed in an aqueous solution of sodium lignin sulfonate, there being present in said composition about one part of weight of the bromide for each 1 to 50 parts by weight of the polysulfide in 500 to 5,000 parts by weight of aqueous dispersion.

2,531,276. Method for Killing Weeds. Patent issued November 21, 1950 to Walter C. Klingel, Basking Ridge, N. J. A method for selectively killing weeds without rendering soil infertile or preventing germination of grass seed therein which comprises applying to growing weeds to be destroyed a water solution containing one part of a compound selected from the group consisting of the alkali metal higher alkyl sulphates and ammonium higher alkyl sulphates together with from five to twenty-five parts of water.

2,531,354. Insecticidal Composition Comprising Heat-Treated Hexaethyl Tetraphosphate. Patent issued November 21, 1950 to Michael N. Dvornikoff, St. Louis, Mo., assignor to Monsanto Chemical Company, St. Louis Mo. An improved insect toxicant comprising the pyrolysis product of hexaethyl tetraphosphate having a specific gravity in the range of 1.30 to 1.35, a viscosity in excess of that of a hexaethyl tetraphosphate and a solubility in xylene ranging from slightly soluble to insoluble, said product being derived by heating hexaethyl tetraphosphate at a temperature in the range of 145° C. to 160° C. for a period of time in the range of 2-5 hours, ethylene being evolved during said heating period.

2,531,390. Insecticide Comprising Rotenone and Piperonyl Cyclonene as a Synergist Therefore. Patent issued November 28, 1950 to Lloyd W. Brannon,

deceased, late of Norfolk, Va. by Leila Brannon, executrix, Norfolk, Va., dedicated to the free use of the People in the territory of the United States. An insecticide comprising from 0.1 to 0.75 percent, by weight, of rotenone and piperonyl cyclonene as a synergist therefor.

2,532,349. Pesticidal or Insect-Repellent Fumigating Compositions. Patent issued December 5, 1950 to James Taylor, Saltcoats, and John Macfie Holm, West Kilbride, Scotland, assignors to Imperial Chemical Industries, Limited. A fumigating composition consisting of a mixture comprising a thermally vaporizable pesticidal compound, at least one nitrogen-containing compound selected from the group consisting of nitroguanidine and guanidine nitrate, and a quantity of a thermal decomposition sensitizer of from 5% to 100% of the weight of the nitrogen-containing compound present, said quantity being sufficient to permit a self-sustained flameless thermal decomposition of said nitrogen-containing compounds in the presence of said pesticidal compound.

2,533,015. Herbicidal Composition. Patent issued December 5, 1950 to Leo Z. Jasion, Elizabeth, and Lawrence T. Eby, Roselle, N. J., assignors to Standard Oil Development Company. A herbicidal composition comprising decyl acetoacetate as the active ingredient admixed with a dispersing agent which lowers the surface tension of water and thereby promotes aqueous emulsions of decyl acetoacetate.

2,533,884. 2,4-Dichlorophenoxyacetic Acid Compositions. Patent issued December 12, 1950 to Everett E. Gilbert, New York, N. Y., assignor to Allied Chemical & Dye Corporation, New York. A liquid composition of matter comprising 2,4-dichlorophenoxyacetic acid as solute in solution in strong sulfuric acid as solvent, said solvent having an H_2SO_4 strength not less than about 85% by weight, the concentration of said solute being not less than about 0.5% by weight based on said solute plus solvent.

2,534,099. Herbicidal Compositions. Patent issued December 12, 1950 to Chester L. Arnold, Berkeley, Calif., assignor to Stauffer Chemical Co., Calif. A composition for killing weeds and defoliating plants, said composition containing perchloro-methyl-mercaptan as an active ingredient in an effective concentration, water and a wetting, dispersing and emulsifying agent.

2,534,277. Crystallization Point Depressants for DDT Hydrocarbon Solutions and Fungicidal Insecticides Obtained Thereby. Patent issued December 19, 1950 to Leo Liberthson, New York, N. Y. and Jacob Faust, Belleville, N. J., assignors to L. Sonneborn Sons, Inc. An insecticidal composition which comprises a petroleum hydrocarbon solution of paradichlordiphenyl trichlorethane having normally a relatively high crystallization point due to the paradichlordiphenyl trichlorethane dissolved therein, a cuprammoniacal petroleum mahogany sulfonate containing occluded oil and at least 5%, by dry weight of said sulfonate, of a phthalic acid aliphatic alcohol ester, said sulfonate and said ester being present in the aggregate to at least 50% by weight of the paradichlordiphenyl trichlorethane in solution, said ester being present in amount up to its solubility limit in said petroleum hydrocarbon.

2,534,485. Photochemical Production of Benzene Hexachloride. Patent issued December 19, 1950 to Warren L. Towle, Akron, Ohio, assignor to Pittsburgh Plate Glass Company, Allegheny County, Pa. A process of producing benzene hexachloride by reacting chlorine with benzene, which comprises subjecting the chlorine to actinic radiation while the chlorine is in a zone spaced from the zone in which the benzene is disposed, and mixing the irradiated chlorine with benzene within one second after irradiation and maintaining the resulting mixture outside the zone of influence of actinic irradiation.

2,534,926. Insecticide Comprising Benzene Hexachloride and Tar Oils. Patent issued December 19, 1950 to Newville F. Rea, Sumner, Washington. An insecticide comprising an emulsible concentrate wherein tar acids and tar acid oils are present to the extent of approximately 72%, and the remainder consists essentially of emulsfying agents and water, in which concentrate has been combined approximately 5% additional of benzene hexachloride containing approximately 10% of the gamma isomer of benzene hexachloride.

2,535,000. Insecticidal Composition Comprising DDT and Methoxychlor. Patent issued December 19, 1950 to Robert A. Sturdy, Quincy, Ill., assignor to Moorman Manufacturing Company, Quincy, Ill. An insecticide composition containing as active ingredients, in synergistically effective proportion, DDT and methoxychlor.

2,535,875. Plant Growth Regulators. Patent issued December 26, 1950 to William D. Stewart, Yonkers, N. Y., assignor to The B. F. Goodrich Company, New York, N. Y. A method of altering growth characteristics of plants which comprises wetting at least a portion of the plant structure with an aqueous composition containing a wetting agent and 0.002% to 5% by weight of a compound having the formula

$$R-A-CH_2CH_2-\overset{\displaystyle O}{\overset{\|}{C}}-Y$$

where R is selected from the class consisting of the hydrogen atom and an aliphatic hydrocarbon radical, A is an atom selected from the class consisting of oxygen and sulfur atoms, and Y is a member selected from the class consisting of the hydroxy radical, an oxy hydrocarbon radical, the amido radical, a hydrocarbon substituted amido radical, an oxy ammonium group, and an oxymetallic group.

2,535,876. Beta-(Heterocyclicthio) Propionic Acid and Derivatives as Plant Stimulants. Patent issued December 26, 1950 to William D. Stewart, Yonkers, N. Y., assignor to The B. F. Goodrich Company, New York, N. Y. A method of altering the growth characteristics of plants which comprises wetting at least a portion of the plant structure with an aqueous composition containing a wetting agent and 0.001% to 5% by weight of a compound selected from the group consisting of beta-(heterocyclicthio) propionic acids having the formula

$$A-S-CH_2CH_2COOH$$

where A is a nitrogen containing heterocyclic radical having its connecting valence on a ring nitrogen atom and an atom selected from the group consisting of sulfur and oxygen and being otherwise composed of carbon and hydrogen atoms, and derivatives of said acids which can be converted to the free acids through hydrolysis involving one molecule of water.

2,538,727. Composition for Control of Mites and Insect Pests. Patent issued January 16, 1951 to Eugene E. Kenaga, Midland, Mich., assignor to The Dow Chemical Co., Midland, Mich. A composition for the control of mite and insect pests comprising as active toxic ingredients (1) tetraethyl pyrophosphate and (2) 4-chlorophenyl 4-chlorobenzene sulfonate.

Trade Mark Applications

AGRIVITA, in capital letters, for organic manure from chickens with no additives during processing. Filed Sept. 26, 1949 by Melson Fertilizer Co., Inc,. Georgetown, Del. Claims use since Jan. 23, 1946.

HOU-ACTINITE, in capital letters, for fertilizer made from raw, activated sewage sludge which is first de-watered by filtration and then heat dryed. Filed Dec. 8, 1949 by the City of Houston, Houston, Texas. Claims use since May, 1949.

TUBERTONE, in capital letters of rustic appearance, word forms semicircle, for chemical preparations useful in the stimulation of seed potatoes. Filed Dec. 14, 1949 by American Chemical Paint Co., Ambler, Pa. Claims use since Feb. 18, 1943.

GRO-TONE, in white capital letters super imposed on black 4-leaf clover, for fertilizer. Filed Jan. 17, 1950 by Wilson and Toomer Fertilizer Co., Jacksonville, Fla. Claims use since Sept. 12, 1949.

GREGGCO, in capital letters sloping upward from left to right and super imposed over a design consisting of straight lines to the left that slope upward above the letters and then circle under the letters and form a loop under the straight parts of the line, there being three lines in all, for soil conditioning material. Filed Jan. 23, 1950 by Gregg Lumber Co., Grand Rapids, Mich. Claims use since Nov. 4, 1949.

Classified Advertising

Rates for classified advertisements are ten cents per word, $2.00 minimum, except those of individuals seeking employment, where the rate is five cents per word, $1.00 minimum. Address all replies to Classified Advertisements with Box Number, care of AGRICULTURAL CHEMICALS, 254 W. 31st St., New York 1. Closing date: 25th of preceding month.

Positions Wanted:

Manager Wanted: Middle west agricultural chemical business needs a capable aggressive manager to continue building a business which has a profitable background, established sales force and is well financed. If you are experienced, capable of earning a good salary and participating bonus write qualifications in details enclosing photograph. All replies confidential. Our employees know of this ad. Address Box No. 499, care of **Agricultural Chemicals.**

Research-Sales: Technical background, several years experience in research work—evaluating insecticides, fungicides and herbicides. Extension experience. Farm background. Desires employment in technical sales or research in East. Address Box No. 503, care of **Agricultural Chemicals.**

Entomologist-Formulating Chemist. Experienced, research and development of household and agricultural insecticides. Exp. in making wettable powders, emulsion concentrates, dusts, aerosols and running bioassays. Experience in commercial field. Ph.D. in near future. Reply to Box No. 502, care of **Agricultural Chemicals.**

Sales Representative — Alabama: Currently employed by U.S. Public Health Service, in Malaria Control work. Graduate Sanitary Engineer desires change to chemicals or agricultural salesman. Well known throughout the state. Open to offer with reliable, aggressive concern. Would consider handling several non-competing products on manufacturers representative basis. Address Box No. 500, care of **Agricultural Chemicals.**

Chemical Engineer: Thirteen years experience in laboratory, production, and engineering: degree in chemical engineering. Can handle plant, production, organic and botanical insecticides: very much interested in sales. Address Box No. 501, care of **Agricultural Chemicals.**

Economic Entomologist, M.S. desires position. 20 years experience with administration, important corporation in the fields of insecticides, fungicides, field tests, representation, insect control. Address Box No. 504, care of **Agricultural Chemicals.**

Research — Development — Sales: Organic chemist with 3 years experience in petroleum field. Three years diversified experience in agricultural chemical field. Now in charge of promotional and sales activities for distributor handling four nationally known brands. Have application experience with herbicides, insecticides and paints. Desires position in research, development, technical sales or combination, with midwest manufacturer, who can use a man with new product ideas. Address Box No. 505, care of **Agricultural Chemicals.**

Miscellaneous:

Sales Representation: Established sales agency covering mid-west area with headquarters in Chicago is in position to represent manufacturer selling chemicals or processing equipment to the agricultural chemicals, chemical specialty and allied industries. If interested in discussing the matter further, write to Box No. 506, care of **Agricultural Chemicals.**

Sales Representation: Eastern manufacturer agricultural chemical products will handle sale agricultural spray or other equipment effectively New England, New York, New Jersey as sales agent. Has plant with ample storage space and siding. Close contacts commercial growers. If interested, address Box 507, care of **Agricultural Chemicals.**

Wanted: DDT, BHC, Toxaphene, Para & Dichlorobenzene, Monochlorbenzene, pine oil, ethanolamines, cellosolves, other supplies. Chemical Service Corp., 86-02 Beaver St., New York 5, N. Y.

For Sale: Surplus Chemicals—Paris Green, Calcium Arsenate, Calgreen. The Balcom Industries, Inc., Greeley, Colorado.

Wanted: Used Ribbon Blender, ½ or one ton capacity, address all offers to Box No. 508 care of **Agricultural Chemicals.**

New Co-op Plant

Indiana Farm Bureau Cooperative Assn., Indianapolis, Ind., has expanded its fertilizer manufacturing facilities by purchase of the Ellis Chemical Co. plant at New Albany, Ind. Erected in 1946, the Ellis factory has modern machinery for making mixed fertilizer as well as for acidulating phosphate rock and producing superphosphate. Production here for the first ten months of 1950 was 46,271 tons. Total production of the co-op's two plants at Indianapolis and Hartsdale, in 1949 was 141,500 tons. The newly acquired facilities, it is expected will raise total production by the Hoosier co-op to well above the 200,000-ton mark for this year.

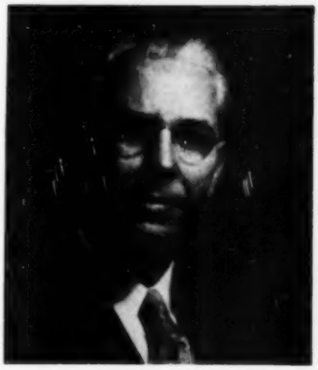
Powell Opens New L. I. Laboratory

JOHN Powell & Co., New York, has announced the opening of new laboratory facilities in Port Jefferson, Long Island, N. Y., for chemical and entomological work connected with production and use of insecticides, herbicides and rodenticides.

The new and modern facilities will handle all control, investigational and research work with the exception of spot control at the Powell manufacturing plants in Brooklyn, N. Y., and Huntsville, Alabama.

The building site for the new insecticide research center was selected because it is adjacent to New York City, and yet lies in the heart of the Long Island agricultural area. Eight acres of land in this farm country will enable the company to embark on special farm programs involving the use of agricultural insecticides and herbicides. There also is ample space for the erection of greenhouse facilities for further research and experimental work aimed at better control of insects.

10,000 square feet of floor space permit the installation of enough facilities to allow several projects to be conducted simultaneously. All of Powell's investigational and research activities on insecticides, herbicides and rodenticides will be centralized under one roof. Dr. Robert C. Haring, recently manager of Powell's Brooklyn plant, has been appointed to direct the activities of the new Port Jefferson research center, according to H. Alvin Smith, company president.



Dr. Robert C. Haring

Defoliation Conference

Revision of a number of phases of cotton defoliation was recommended at the fifth annual Beltwide Cotton Defoliation Conference held at Memphis, Tenn., January 11 and 12. The steering committee recommended studies of varietal characteristics of cotton plants; influence of defoliation or efficiency of mechanical harvesting, comparison of defoliants and the effect of chemical defoliants on quantity and quality of cottonseed and lint. Studies on the influence of defoliation on hand picking should be left to individual cooperators, the committee said.

The group also voted to issue a summary of defoliation recommendations for the guidance of cotton producers, agricultural workers and other agencies. It also recommended that a progress report of defoliation, containing more specific recommendations, be published. The members of the steering committee are Dr. W. H. Tharp, Principal Physiologist, Division of Cotton and Other Fiber Crops and Diseases, United States Department of Agriculture, Beltsville, Maryland; Don L. Jones, Superintendent, Texas Agricultural Experiment Station No. 8, Lubbock, Texas; William E. Meek, Agricultural Engineer, Cotton Mechanization Project, Delta Branch Experiment Station, Stoneville, Mississippi; C. B. Haddon, Superintendent, North East Louisiana Experiment Station, St. Joseph, Louisiana; I. M. Parrott, Superintendent, Oklahoma Cotton Experiment Station, Chickasha, Oklahoma; Tildon Easley, Agriculturist, American Cyanamid Company, Little Rock, Arkansas, and Leonard Lett, National Cotton Council, Memphis, Tennessee.

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St. Regis Combines Depts.

St. Regis Paper Company, New York, last month announced the establishment of a consolidated research and development department under the direction of Dr. Kenneth A. Arnold. The department will perform the functions previously conducted separately for the Printing, Publication & Converting Paper Division, the Kraft Pulp & Paper Division and the Multiwall Bag Division of the company.

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Sets New Safety Record

With a million man-hours without a lost time accident behind them, employees of the Davison Chemical Corporation in Bartow, Fla., are well on their way to what may be a national record for safety in the phosphate mining industry.

Dr. Allen T. Cole, manager of the Florida Phosphate Rock Division for Davison, reports that the firm had been commended for its achievement during the past year by the National Safety Council in Chicago. It was believed by Davison officials that this is the first time that a 1,000,000 work-hour safety record has ever been recorded in the phosphate mining industry.

California Weed Conference Attracts 450

EDUCATIONAL aspects of weed control were emphasized at the third annual California Weed Conference held at Fresno State College, January 30-February 1. Reports of progress made in weed control were presented by Professor F. Sharp, Director of the Calif. Agri. Experiment Station, Berkeley; J. Earl Coke, Director of the Calif. Extension Service; and Walter S. Ball, chief of the Bureau of Rodent and Weed Control and Seed Inspection, Calif. Department of Agriculture, Sacramento.

"What is new in weed control" was discussed by William A. Harvey, extension weed specialist, U. of Calif., Davis, who was chairman of a panel discussion on this subject. A question and answer period followed. Another session on brush clearance and range management was under the chairmanship of Prof. B. A. Madson, Univ. of Calif., Davis. Included in the papers delivered at this session were those by DeWitte Nelson, Div. of Forestry; H. H. Biswell, U. of Calif. School of Forestry, Berkeley; and J. P. Conrad, U. of Calif. agronomist, on range fertilization.

Paul Baranek, weed control specialist for the Department of Reclamation, was chairman of a program featuring talks on weed control along highways, and railroads, county weed control and soil sterilants.

On the final day, Dr. W. W. Robbins, professor of botany, U. of Calif. conducted a session on "Let's go to school", creating a schoolroom atmosphere with his listeners acting as the "pupils". Some of the subjects discussed included "What makes a plant grow?" by Dr. Robbins, "Chemistry and weed killers," by Dr. A. S. Crafts. "Herbicide application", by W. A. Harvey; and "Weed control machinery", by Norman B. Akesson.

Charles V. Dick, chief of the bureau of plant industry, Calif. Department of Agriculture, was chairman of the last session on Thursday, dealing with regulations. Registration at the meeting totaled 450, with many others in attendance who failed to register.

Officers elected included M. R. Pryor, Calif. Dept. of Agriculture, president; Dr. R. H. Offord, U.S.D.A., vice-president; W. A. Harvey, secty-treas.; and Frank B. Herbert, Shell Chemical Laboratory, Modesto, recording secretary.

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Purdue Conference in Mar.

Plans for the Purdue University conference on the use of aerial equipment in agriculture were not complete as this issue went to press, but an informative program was under way for the two-day school March 19 and 20. According to Dr. J. J. Davis, head of the Purdue Department of Entomology, Lafayette, Ind., the program will include talks on problems involved in insect control from the standpoints of toxicology, application, and materials used. Studies of new insecticides will be made, and discussions will be held on liability, safety, and other problems connected with aerial application of pesticides.

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H. R. Talmage Dies

Henry R. Talmage, 79, president of the Long Island Produce & Fertilizer Co., Riverhead, L.I., died at his home January 28. A native of Long Island, he had been named a master farmer of New York State in 1929. He was a member of Gov. F. D. Roosevelt's agricultural advisory commission, and had been appointed by the Governor to the N. Y. State Banking Board.

Mr. Talmage founded the L. I. Produce & Fertilizer Co. in 1922 with the late C. H. Young.

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Huber Mkt. Res. Director

Jack Watson has been appointed director of market research for the industrial products department of J. M. Huber Corp., New York, R. H. Eagles, vice president has announced. Mr. Watson will investigate the applications and uses of new products and Huber clays in the paper, ceramic, insecticide and adhesive industries. Mr. Watson was formerly manager of technical services of Huber's Ink Division, and, prior to that, was director of that division's laboratories and production manager.

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Superphosphate Output Up

A total of 854,285 tons of normal, concentrated and wet-base superphosphate were produced during November, 1950, the Bureau of Census reports.

Output of normal superphosphate was up 2 per cent from October, but concentrated dropped 8 per cent. The bureau said the biggest decline was felt in production of wet-base goods. It declined 40 per cent from October levels.

All superphosphate production, however, showed percentage increases from November, 1949.

Shipments of normal declined 9 per cent from October, while concentrated and wet-base goods declined 25 and 23 per cent, respectively.

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Betner Adds to Sales Staff

Benj. C. Betner Co., Devon, Pa. has announced the addition of seven men to its sales organization. E. V. Ballard, formerly associated with Thomas M. Royal Co. is now with Betner as metropolitan New York sales manager and assistant to B. C. Betner, Jr., vice-president. R. George Buchanan, Jr., formerly sales manager of automatic bags with the Royal Co., will be sales manager of "Flavotainer" bag sales and specialty items at the company's home office, Devon, Pa. Five sales representatives, all formerly with the Royal Co., joined Betner on January 1. They include J. Ackert and J. Rex, who will be representatives in metropolitan New York working out of Betner's New York office in the Daily News building. E. Kassing and W. Gilmore will work out of the company's Chicago office as midwestern representatives. B. Dickinson will cover the southeastern district of the United States with headquarters in Atlanta, Ga.

New Calspray Miticide

A new development in miticides is "Ortho-Mite," formulated by the California Spray-Chemical Corp., Richmond, Calif. This new insecticide has given superior control, from coast to coast, of the Citrus Red Mite, Clover Mite, Pacific Mite, European Red Mite, and Two Spotted Mite on citrus, apples, grapes, peaches, pears and nursery plants, the makers state.

In field tests on citrus plots each application of "Ortho-Mite" gave outstanding results for long periods of time. Other tests show that unusually effective control can be achieved by spraying or dusting orchard, nursery or garden crops every 2 or 3 months.

Other important advantages of the new product are effectiveness at economical rates of application, and high compatibility with oils, wettable powder formulations of BHC, DDT, chlordane, lindane, Methoxychlor, toxaphene, parathion, sulfur, lead arsenate and ferbam. "Ortho-Mite" is said to be non-irritating to most operators and has low toxicity to warm-blooded animals.

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9th Entoma to Appear Soon

The ninth edition of *Entoma* is soon to be published, according to George S. Langford, editor. Dr. Langford, of the University of Maryland's department of entomology, states that the book, a directory of insect pest control, is being revised by the American Association of Economic Entomology which publishes the book.

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Canners Meet Feb. 17-24

Program plans for the 44th annual convention of the National Canners Association were completed as we went to press. The meeting, scheduled to be held February 17-20 at the Stevens Hotel, Chicago, was to include an address by Charles E. Palm, Cornell University, on "Pesticide Problems from the Standpoint of Canning Crops"; a talk by Dr. Russell Coleman, president, National Fertilizer Association, Washington, on "Fertilizers in Relation to Food Composition"; and a discussion on "A Practical Field Control Program for Corn Insects" by Dr. George C. Decker, Illinois Natural History Survey, Urbana, and Dr. L. P. Ditman, Maryland Experiment Station. Charles H. Mahoney, director of the Raw Products Research Bureau of the N.C.A., was to preside at the session on raw products on Monday.

Advertisers' Index

(The Advertisers' Index has been checked carefully but no responsibility can be assumed for any omission)

Tale Ends . . .

AS we slowly, but surely switch over to a war economy, the gems of language and literature emanating from our nation's capital increase apace. The most recent to come to our attention is NACA Joe Noone's one-sentence estimate of the current situation: "The confusion in Washington as yet has not been well organized!"

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Under the slogan, "Everybody talks about the weather, but we do something about it", the National Weather Improvement Association held its first meeting January 11 & 12 in Denver. The group is composed of "cloud seeding" enthusiasts, some of whom are agriculturists interested in stepped-up rainfall. According to James Wilson, Ft. Collins, Colo., secretary of the Association, the purpose of the organization is "to insure that these weather-improvement developments proceed in an orderly fashion and that this great new force is directed into constructive channels for the best interests of the whole country."

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"Recognizing a man who not only made a notable contribution to Texas agriculture, but to the effectiveness of cotton insect control throughout the South," K. P. Ewing, a Bureau of Entomology and Plant Quarantine entomologist, was selected the 1950 "Texas Man of the Year," by one of the leading southern agricultural publications, "for the part he played in the development of a more effective cotton insect control program for the area."

Ewing, a Mississippi farm boy, has been engaged in cotton insect control investigations with BEPQ for 30 years, all but six of which have been in Texas. His Waco, Texas laboratory was recognized by USDA in 1949 with one of the Department's "Superior Service" awards for "outstanding achievements in the development and application of new insecticides for the control of cotton insects."

Mr. Ewing and his associates have been especially successful in getting farmers to follow approved methods for control of cotton insect pests, particularly when applied on a community basis. In 1950, farmers in one Texas County, McLennon, made almost $3 million additional profit through following the advice and recommendations of Ewing and the Texas Agricultural Extension Service. Some farmers in the control area netted $79.24 an acre more by following the program. One farmer, in Kaufman County, made 670 pounds of lint per acre and paid for his farm in 1950.

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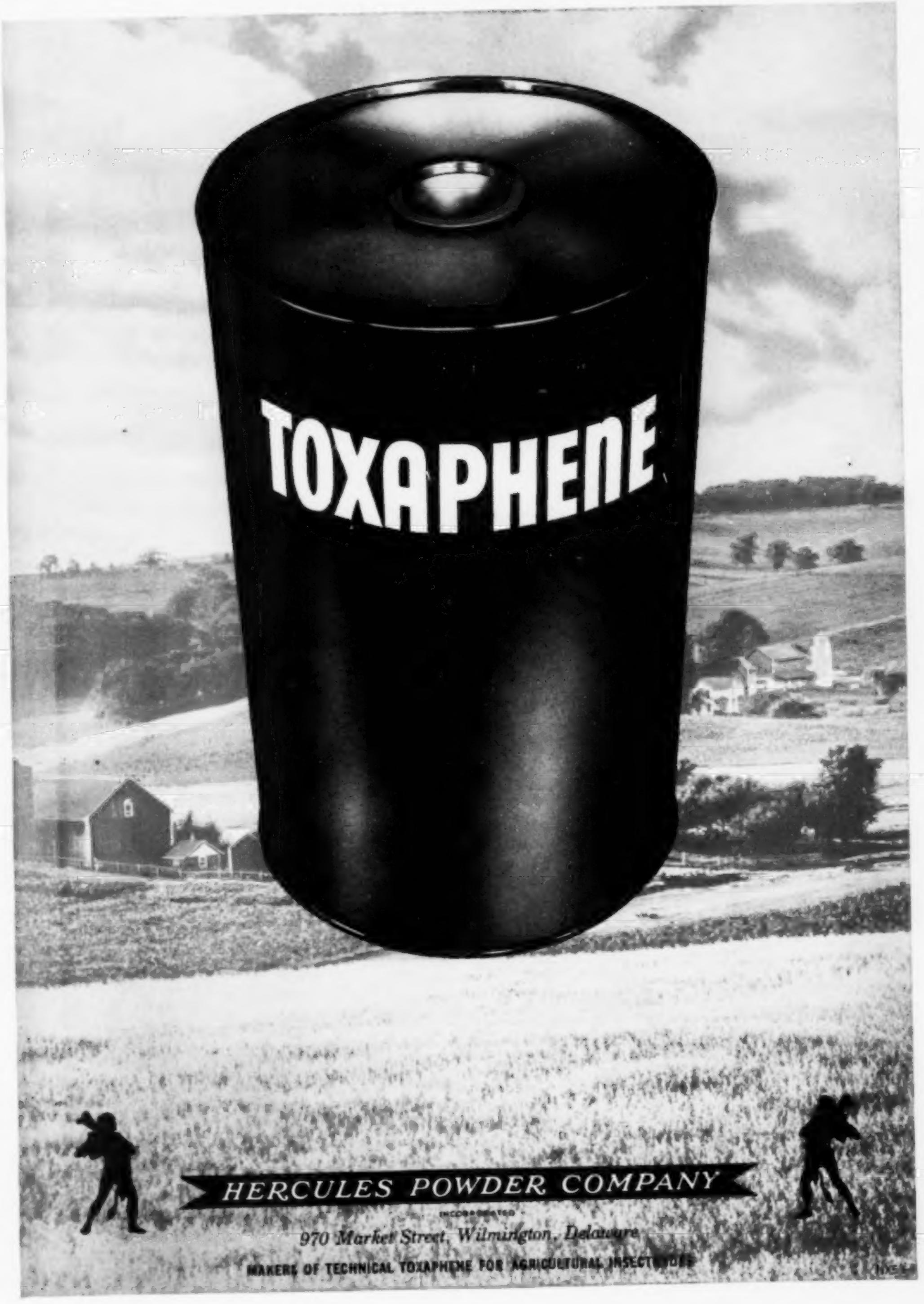
Grover C. Guernsey has been elected the new president of the New York State Holstein-Friesian Association.



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